SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

SEVENTH YEAR.
VOL. XIV. No. 358.

NEW YORK, DECEMBER 13, 1889.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

A NEW DYNAMO AND PROJECTOR.

A PERFECT dynamo must be correctly designed both electrically and mechanically, in which case it is, with ordinary management, certain to operate with satisfaction to the user, good material and workmanship being presupposed. From the fact that dynamos are necessarily designed by electricians, it has been observed heretofore that many types have been unsatisfactory in mechanical performance. The new dynamo of the United States Electric Lighting Company, here illustrated, has had the benefit of many years of development. The patterns for it have recently been entirely remodelled, to take advantage of the best points in the antecedent dynamos of both the Westinghouse and United States Companies, and it is consequently a most practical and efficient generator.

The field-magnets part along a horizontal plane, so that, by removing the yoke and unbolting the two halves, the upper half can be lifted away and the armature removed. This is convenient in cramped situations. The same construction enables it to be carried into restricted locations which would not be accessible to a dynamo built in one piece. The armature itself is wound in a single layer upon a laminated core, practically obviating the liability to heating. Ball bearings are used on both ends of the shaft.

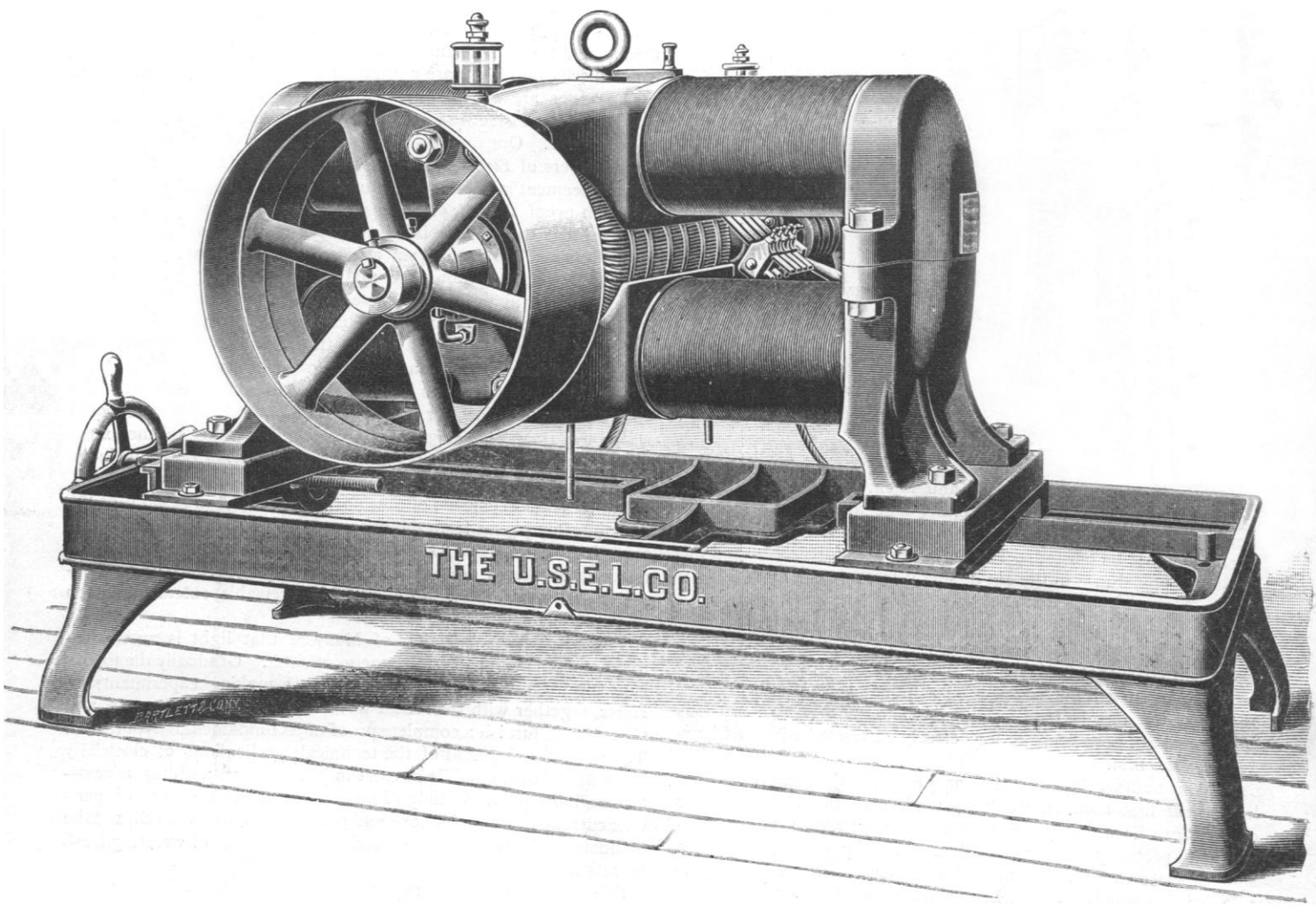

FIG. 1.—NEW DYNAMO WITH ELEVATED BASE.

The lower horn of the casting is hollow, and serves as a reservoir for oil running through the bearings. Oil can therefore be supplied copiously, and drawn off and returned to the cups without waste. The dynamo is carried on an elevated base, making it more accessible to the operator. If desired, the legs may be removed, and the base bolted to a foundation. The base is provided with the usual tension-screw.

The United States electric-light projector is shown in Fig. 2. It has both a horizontal and vertical motion, so that the light can be thrown in any direction. It carries a focusing-lamp in a parabolic reflector. When out of service, the case is rigidly locked in position by clamps at the side and a catch at the base, protecting it against the jarring of a sea-way or otherwise. The glass face is in strips to avoid cracking from unequal expansion. Its hinges

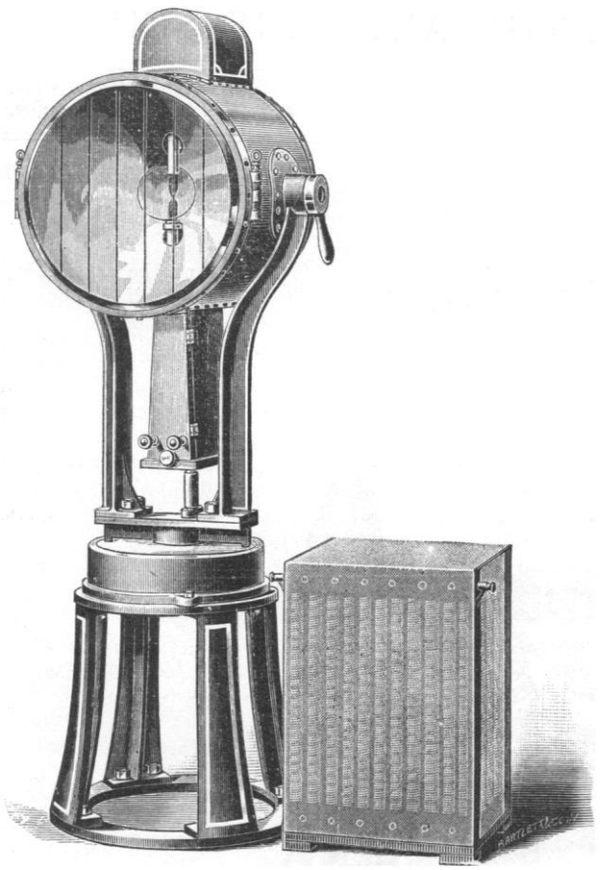

FIG. 2. — ELECTRIC PROJECTOR.

are made to act both as hinges and latch, so that by drawing a pin the face can be opened on either side at will. All adjustments are outside the case, so that the doors leading to the lamp-works need not be opened. The lamp requires forty volts, and the resistance-box shown in the cut adapts it to any circuit.

TWENTY YEARS.[1]

A REMINDER that to-day is the twentieth anniversary of the first issue of *Nature* will not, perhaps, be without interest to our readers, and certainly affords food for reflection to those who in various capacities have been more or less closely connected with this journal from the first.

"When another half-century has passed," said Professor Huxley in our first number, "curious readers of the back numbers of *Nature* will probably look on *our* best 'not without a smile.'"

It will probably be so; but, though twenty years is hardly a sufficient interval to make our smiles at our earlier efforts supercilious, it is enough to test whether progress has been made, and whether the forward path is pursued with growing or with waning force.

As regards this journal itself, we may claim that it has not disappointed the hopes of its founders, nor failed in the task it undertook; and we make this claim all the more emphatically because we feel that what has been accomplished has not been due to our own efforts so much as to the unfailing help we have always received from the leaders in all branches of natural science. This help has not been limited to their contributions to our columns, but has consisted also of advice and suggestions which have been freely asked and as freely given. Not the least part of our duty, and even privilege, to-day, is to state openly how small our own part has been, and to render grateful thanks to those to whom it is chiefly due that *Nature* has a recognized place in the machinery of science, and has secured an audience in all parts of the civilized world.

We do not wish, however, to narrow our retrospect of the last twenty years by confining our attention to the measure of success which these pages have won. It has been attained, as we have shown, by the aid of nearly all the best-known scientific writers and workers, not in Britain only, but in many countries old and new; and we cannot believe that they would thus have banded themselves together, if evidence had not been given of an honest desire for the good of science and for the "promotion of natural knowledge," or if the attainment of these objects had not been regarded by us as of more importance than a journalistic success. Thus, on its twentieth birthday, we would think not so much of the growth of *Nature* as of the advance which in the last twenty years it has chronicled.

A formal history of science for that period would be a formidable task, but it is already possible to discern what will probably appear to posterity to be the most salient characteristics of the last two decades.

In the physical sciences, the enormous development of the atomic theory, and the establishment of a connection between the theories of electricity and light, are perhaps the two main achievements of the years we are considering. Methods of accomplishing the at first sight impossible task of measuring atomic magnitudes have been devised. Our own volumes contain some of the most interesting papers of Sir William Thomson on this subject; and the close agreement in the results attained by very different methods is sufficient proof, that, if only approximations, they are approximations we may trust. The brilliant vortex atom theory of Sir William Thomson has not as yet achieved the position of a proved hypothesis, but has stimulated mathematical inquiry. A number of very powerful researches have added to our knowledge of a most difficult branch of mathematics, which may yet furnish the basis of a theory which shall deduce the nature of matter and the phenomena of radiation from a single group of assumptions.

The theory of gases has been extended in both directions. The able attempt of Van der Waals to bring both vapor and liquid within the grasp of a single theory is complementary to the extension by Crookes, Hittorf, and Osborne Reynolds, of our knowledge of phenomena which are best studied in gases of great tenuity.

The gradual expansion of thermodynamics, and in general of the domain of dynamics from molar to molecular phenomena, has been carried on by Willard Gibbs, J. J. Thomson, and others, until, in many cases, theory seems to have outrun not only our present experimental powers, but almost any conceivable extension which they may hereafter undergo.

The pregnant suggestion of Maxwell that light is an electromagnetic phenomenon has borne good fruit. Gradually the theory is taking form and shape; and the epoch-making experiments of Hertz, together with the recent work of Lodge, J. J. Thomson, and Glazebrook, furnish a complete proof of its fundamental hypotheses. The great development of the technical applications of electricity has stimulated the public interest in this science, and has necessitated a more detailed study of magnetism and of the laws of periodic currents. The telephone and the microphone have eclipsed the wonders of the telegraph, and furnish new means of wresting fresh secrets from nature.

Science has become more than ever cosmopolitan, owing chiefly to the imperative necessity for an early agreement as to the values of various units for a common nomenclature, and for simultaneous observations in widely separated localities. International conferences are the order of the day, and the new units which they have defined are based upon experiments by many first-rate observers in many lands, among whom the name of Lord Rayleigh stands second to none.

On the side of chemistry, the periodic law of Mendeleeff has become established as a generalization of the first importance, and the extraordinary feat of foretelling the physical properties of an as yet

[1] From Nature, Nov. 7, 1889.

undiscovered element has attracted to it the attention of the whole scientific world.

The once permanent gases are permanent no more. Dulong and Petit's law has found a complement in the methods of Raoult. The old doctrine of valency is giving way to more elastic hypotheses. The extraordinary progress of organic chemistry, which originated in the work and influence of Liebig and the Giessen school, has continued at an accelerated rate. The practical value of even the most recondite investigations of pure science has again been exemplified by the enormous development of the coal-tar industry, and by the numerous syntheses of organic products which have added to the material resources of the community.

The increase of our knowledge of the sun by means of localized spectroscopic observation, the application of photography to astronomy, and, more recently still, the extension and generalization of the nebular hypothesis, are perhaps the most remarkable developments of those branches of science which relate to astronomy. Stars which no human eye will ever see are now known to us as surely as those which are clearly visible. The efforts to reduce nebulæ, comets, and stars under one common law, as various cases of the collision or aggregation of meteoritic swarms, and the striking investigations of Professor Darwin on the effects of tidal action and on the application of the laws of gases to a meteoritic plenum, give promise of a fuller knowledge of the birth and death of worlds.

In the biological sciences, the progress during the last twenty years has consisted chiefly in the firm establishment of the Darwinian doctrine, and the application of it and its subordinate conceptions in a variety of fields of investigation. The progress of experimental physiology has been marked by increasing exactitude in the application of physical methods to the study of the properties of living bodies; but it has not as yet benefited, as have other branches of biology, from the fecundating influence of Darwin's writings: hence there is no very prominent physiological discovery to be recorded. The generation of scientific men which is now coming to middle age has been brought up in familiarity with Mr. Darwin's teaching, and is not affected by any thing like hostility or *a priori* antagonism to such views. The result is seen in the vast number of embryological researches (stimulated by the theory that the development of the individual is an epitome of the development of the race) which these twenty years have produced, and in the daily increasing attention to that study of the organism as a living thing definitely related to its conditions which Darwin himself set on foot. The marine laboratories of Naples, Newport, Beaufort, and Plymouth, have come into existence (as in earlier years their forerunners on the coast of France), and served to organize and facilitate the study of living plants and animals. The "Challenger" and other deep-sea exploring expeditions have sailed forth and returned with their booty, which has been described with a detail and precision unknown in former times. The precise methods of microscopic study by means of section-cutting — due originally to Stricker of Vienna — have within these twenty years made the study of cell-structure and cell-activity as essential a part of morphology as it had already become of physiology. These, and the frank adoption of the theory of descent, have swept away old ideas of classification and affinities, and have relegated the ascidian "polyps" of old days to the group of *Vertebrata*, and the sponges to the cœlenterates. The nucleus of the protoplasmic cell — which twenty years ago had fallen from the high position of importance accorded to it by Schwann — has, through the researches of Bütschli, Flemming, and Van Beneden, been reinstated, and is now shown to be the seat of all-important activities in connection with cell-division and the fertilization of the egg. The discovery of the phenomena of karyokinesis and their relation to fertilization will be reckoned hereafter as one of the most, if not the most, important of the biological discoveries of the past twenty years.

Apart from Darwinism, the most remarkable development of biological studies during these "twice ten tedious years" is undoubtedly the sudden rise and gigantic progress of our knowledge of the bacteria. Though the foundations were laid fifty years ago by Schwann and Henle, and great advances were made by Pasteur and by Lister just before our period, yet it is within this span that the microscope and precise methods of culture have been applied to the study of the "vibrions," or "microbes," and the so-called "bacteriology" established. We now know, through the labors of Toussaint, Chauveau, Pasteur, and Koch, of a number of diseases which are definitely caused by bacteria. We also have learned from Pasteur how to control the attack of some of these dangerous parasites. Within these twenty years the antiseptic surgery founded by Sir Joseph Lister has received its full measure of trial and confirmation, while his opportunities and those of his fellow-countrymen for making further discovery of a like kind have been ignorantly destroyed by an act of Parliament.

To particularize some of the more striking zoölogical discoveries which come within our twenty years, we may cite the dipnoous fish-like creature *Ceratodus* of the Queensland rivers, discovered by Krefft; the jumping wheel-animalcule *Pedalion*, of Hudson; the development and the anatomy of the archaic arthropod *Peripatus* worked out by Moseley, Balfour, and Sedgwick; the *Hydrocorallinæ* of Moseley, an entirely new group of compound animals; the fresh-water jelly-fish *Limnocodium* of the Regent's Park lily-tank; the Silurian scorpion of Gotland and Lanarkshire; the protozoon *Chlamydomyxa* discovered by Archer in the Irish bogs; the *Odontornithes* and the *Dinocerata* of the American paleontologists; the intracellular digestion obtaining in animals higher than *Protozoa*, and the significance of the "diapedesis" of blood-corpuscles in inflammation, and the general theory of phagocytes due to Mecznikow; the establishment of the principle of degeneration as of equal generality with that of progressive development, by Anton Dohrn; the demonstration by Weismann and others that we have no right to mix our Darwinism with Lamarckism, since no one has been able to bring forward a single case of the transmission of acquired characters. Perhaps the attempt to purify the Darwinian doctrine from Lamarckian assumption will hereafter be regarded, whether it be successful or not, as the most characteristic feature of biological movement at the end of our double decade. Its earlier portion was distinguished by the publication of some of Darwin's later works. Its greatest event was his death.

In botany, twenty years ago, the teaching in our universities was practically sterile. In one of our earliest numbers, Professor James Stewart defended with some vigor the propriety of intrusting botany to a lecturer at Cambridge who was also charged with the duty of lecturing on electricity and magnetism. It is startling to compare a past, in which botany was regarded as a subject which might be tacked on anywhere, with its present condition, in which there is scarcely a seat of learning in the three kingdoms which is not turning out serious work. The younger English school would be ungrateful if it did not acknowledge its debt to the eminent German teachers from whom it has derived so much in the tradition and method of investigation. Sachs and De Bary have left an indelible mark on our younger professors. But it would be a mistake to suppose that English modern botany has simply derived from Germany. It has developed a character of its own, in which the indirect influence of Darwin's later work can be not indistinctly traced. There has been a gradual revolt in England, the ultimate consequences of which have still to be developed, against the too physical conception of the phenomena of plant-life which has been prevalent on the Continent. Darwin, by his researches on insectivorous plants and plant movements from a purely biological point of view, prepared the way for this; Gardiner followed with a masterly demonstration of the physical continuity of protoplasm in plant-tissues. This has thrown a new light on the phenomena studied by Darwin; and we need not, therefore, be surprised that his son, F. Darwin, has started what is virtually a new conception of the process of growth, by showing that its controlling element is to be sought in the living protoplasm of the cell rather than in the investing cell-wall. On the whole, English botanists have shown a marked disposition to see in the study of protoplasm the real key to the interpretation of the phenomena of plant-life. The complete analogy between the processes of secretion in animals and vegetables established by Gardiner, and the essential part played by ferments in vegetable nutrition, illustrated by Green, are examples of the results of this line of inquiry. To Germany we owe a flood of information as to the function of the cell-nucleus, which, it is singular, has met with general acceptance but little detailed corroboration in this country.

In morphology a review would be ineffective which did not go somewhat deeply into detail. The splendid hypothesis of Schwendener, of the composite nature of lichens as a commensal union of *Algæ* and *Fungi*, has gradually won its way into acceptance. In England there is little of the first rank which calls for note except the researches of Bower on the production of sexual organs on the leafy plant in ferns without the intervention of an intermediate generation.

In vegetable physiology there seems a pause. The purely physical line of inquiry, as already suggested, seems to have yielded its utmost. The more biological line of inquiry has only yet begun to yield a foretaste of the results which will undoubtedly ultimately flow from it.

Something must be added as to systematic and geographical botany. The "Genera Plantarum" of Bentham and Hooker, the work of a quarter of a century at Kew, affords a complete review of the higher vegetation of the world, and has been accepted generally as a standard authority. To Bentham also we owe the completion of the "Flora Australiensis," the first complete account of the flora of any great continent.

In geographical botany, perhaps the most interesting results have been the gradual elaboration of a theory as to the distribution of plants in Africa, and the botanical exploration of China, of the vegetable productions of which, twenty years ago, almost nothing was known.

In the classification of the lower plants, perhaps the most interesting result has been the happy observations of Lankester upon a colored bacterium, which enabled him to show that many forms previously believed to be distinct might be phases of the same life-history.

In geology probably the greatest advance has been in the application of the microscope to the investigation of rock-structure, which has given rise to a really rational petrology. All except the coarser-grained rocks were only capable of being described in vague terms. With modern methods, their crystalline constituents are determinable, however minute, and the conditions under which they were formed can be inferred.

It is impossible, even in a brief review of this kind, to think only of what has been won, and to ignore the loss of leaders who were once foremost in the fray. In England three names which will never be forgotten have been removed from the muster-roll. Darwin, Joule, and Maxwell can hardly be at once replaced by successors of equal eminence. As the need arises, however, men will no doubt be found adequate to the emergency, and it is at least satisfactory to know that they will appeal to a public more capable than heretofore of appreciating their efforts.

The support afforded by the governments of western Europe to scientific investigation has been markedly increased within the period which we survey. France has largely extended her subsidies to scientific research, while Germany has made use of a large part of her increased imperial revenue to improve the arrangements for similar objects existing in her universities. The British Government has shown a decided inclination in the same direction: the grant to the Royal Society for the promotion of scientific research has been increased from £1,000 to £4,000 a year; while subsidies have been voted to the Marine Laboratory at Plymouth, to the Committee on Solar Physics, to the Meteorological Council, and quite recently to the university colleges throughout the country; of which last it is to be hoped that a fair proportion will be devoted to the promotion of research rather than to the reduction of class fees.

Twenty years ago, England was in the birth-throes of a national system of primary instruction. This year has seen the state recognition of the necessity of a secondary and essentially a scientific system of education, and the Technical Instruction Act marks an era in the scientific annals of the nation.

The extension of scientific teaching has gone on rapidly within and without our universities. Twenty years ago the Clarendon Laboratory at Oxford was approaching completion, and was the only laboratory in the country which was specially designed for physical work. Now, not only has Cambridge also its Cavendish Laboratory, but both universities have rebuilt their chemical laboratories, both have erected buildings devoted to the study of biology, and the instruction of students in both zoölogy and botany has taken a characteristic practical form which we owe to the system of concentrating attention on a series of selected "types" introduced by Rolleston and by Huxley. Oxford has been furnished with an astronomical observatory by the liberality of Warren de la Rue, and Cambridge has accepted the noble gift of the Newall telescope. Nor have such proofs of the vitality of science been confined to the universities.

Twenty years ago the Owens College was a unique institution. Now, united with two thriving colleges in Leeds and Liverpool, it forms the Victoria University; while science is studied in appropriate buildings in Birmingham, Newcastle, Nottingham, and half a dozen towns beside.

A race is thus springing up which has sufficient knowledge of science to enforce due recognition of its importance; and public opinion can now, far more than in the past, be relied on to support its demands. Fortunately, too, these can be authoritatively expressed. The Royal Society wields, if it chooses to exercise it, an enormous power for good. Admitted on all hands to be the supreme scientific authority in this country, its decisions are accepted with a deference which can spring only from respect for the knowledge and scrupulous fairness by which they are dictated. If sometimes it moves slowly, it is delightful to turn from the babble of the politicians to the study of an institution which does its work well, and perhaps too noiselessly. But even the House of Commons, hitherto ignorant and therefore apathetic in matters scientific, is awakening to the fact that there are forces to be reckoned with, and impulses to be stimulated and controlled, which are of more enduring import to the national welfare than mere party politics. And the people, too, are beginning to see that it is to the economic working of these forces, and to the right direction of these impulses, that their representatives are bound to give attention. True it is that another generation may possibly pass away before either the House of Commons or even ministers are sufficiently instructed in science to recognize fully their responsibility in this direction.

Whatever, then, the future may bring, the last twenty years have been characterized by progress both steady and rapid. The tide flows on with no sign of check, and we accept the success of *Nature* in no spirit of self-gratulation, but as a straw by which the speed of the current may be gauged.

HEALTH MATTERS.

Ozone in the Treatment of Phthisis.

RANSOME records the treatment of thirteen cases of pulmonary tuberculosis by the inhalation of ozone. Each cylinder used contained seven litres of pure oxygen ozonized up to nine per cent. No other treatment was employed. The cases represented various stages of the disease, and were all under observation for more than one year. The author says that the results obtained were a continuous freedom from fever, absence of night-sweats, diminished expectoration, and great gain in weight and strength.

The author believes that ozone does not act as a direct germicide, and that the control over the disease does not seem to come from any direct action upon the tubercle bacillus. It acts by restoring tone to diseased portions, and has a beneficial effect on the general health.

In the paper the daily notes are given of each case. As the *Brooklyn Medical Journal* observes, one can hardly find the author's conclusions in these notes. In one case, certainly, the inhalations caused a fresh bronchitis, and emesis also ocurred in others. These patients, perhaps, would have improved quite as much if no ozone had been given, as they received good care and good food. The author offers the treatment as giving the best results as yet obtained.

NEW JERSEY SANITARY ASSOCIATION. — The New Jersey Sanitary Association met in the State House, Trenton, on Nov. 22 and 23. The officers were Dr. Dowling Benjamin of Camden, president; and Dr. D. C. English of New Brunswick, secretary. Papers were read on the following subjects: "The East Orange Sewage Disposal Works," by C. P. Bassett, C.E.; "The Passaic

River Drainage," by G. W. Howell, C.E.; "The Improvement of Sanitary Conditions in the Health and Pleasure Resorts of New Jersey," by Dr. Henry Mitchell; "The Climatic Treatment of Gastro-intestinal Diseases in Children," by Dr. Boardman Reed; "The Need of Medical Officers in School Districts," by Dr. G. F. Wilbur; "Physical Culture in the Schools in its Hygienic Bearings," by Professor James M. Green; "The Relation of Conduits to the Healthfulness of Water," by Dr. W. K. Newton; "Tuberculosis," and "Typhoid-Fever in Munich," by Professor S. G. Dixon of the University of Pennsylvania; "The Present Special Sanitary Needs of our Cities," by James C. Bayles, formerly president of the New York City Board of Health. The annual address by the president was on "The Thermometry of Hygiene."

HIGH ALTITUDE TREATMENT OF PHTHISIS. — Tyson offers certain considerations on this topic from climates marked by (1) extreme purity of the air, (2) aerial rarefaction, (3) low relative humidity, and (4) immunity from wind, fog, and miasmal emanations. The cases sent to such climates should be carefully selected. No case should be sent in which there is senile change, laryngeal ulceration, gout, rheumatism, organic nerve-disease, or hysteria. When there is no marked emaciation, severe pyrexia, or kidney complication, Mr. Tyson finds that the cases do well. An important rule is that the patient should live continually in the chosen place, and not return, even for short visits, to lower altitudes. This length of time, as we learn from the *Brooklyn Medical Journal*, he believes should be fully two years. Cold, dry air is stimulating. It is detrimental to all fungous growth. The secretion from a cavity has a tendency to dry up. Its rarefaction increases the number of respirations, and has a considerable influence in permanently expanding the lungs. Slight oozing of blood from the mouth, nose, and throat is common when patients first arrive. It may be that the mucous membranes near the surface of the body become dry, and there may be blood stasis, especially when the air is cold. In the lungs, however, the supply of watery fluid is so great that dryness is impossible, and, at the same time, the air is warm before it reaches the lungs. The removal of watery vapors would even relieve the congestion without bleeding. It may be, however, that the diminished air-pressure tends to draw the blood to the surface, and so cause the bleeding. Mr. Tyson finds that these slight hemorrhages do not harm, and that the membranes soon become accustomed to the changes in the air.

THE ACIDS OF THE STOMACH. — There is no doubt that the chief acid found in the stomach during natural digestion is free hydrochloric acid. According to *The British Medical Journal*, this has been abundantly proved by Bidder and Schmidt, and numerous observers succeeding them. The methods used are, however, too long and too complicated to employ in clinical work. The physician wishes to know what, in a particular case of disease, are the chemical changes going on in the stomach; whether, for example, hydrochloric acid is present, as well as pepsin and organic acids. Now, in the examination of the contents of a diseased stomach, three forms of acid may be present, — hydrochloric acid, a mineral acid; organic acids, such as lactic acid, butyric, etc.; and, thirdly, acid phosphates. It is chiefly of importance to determine the presence of hydrochloric acid and of organic acids. Many methods have been proposed for doing this: they consist mainly in testing the effect of the stomach contents on various colored solutions. Thus a solution of methyl-violet is decolorized by hydrochloric acid, so that, if this re-action is obtained, the free acid is present in the liquid tested. Lactic acid turns the violet a dirty yellow. Tropæolin also is turned deep reddish-brown by free hydrochloric acid. Unfortunately these tests, simple as they appear, are not accurate, since the re-actions are interfered with by the presence of peptones and of some neutral salts; and, as these are usually present in the stomach contents, no reliable results can be obtained by using methyl-violet and tropæolin. They have been superseded by congo-red, which is turned blue by free hydrochloric acid, and by a solution of vanillin and phloroglucin in alcohol, which is turned a deep red by the same acid. These simple clinical tests are, however, rendered useless by the fact that they are interfered with by the presence of peptone, ammonium salts, chlorides, and phosphates. In the present state of our knowledge, therefore, there is no reliable indicator for the presence of free hydrochloric acid in the stomach contents. Other methods which may be used are too complicated for clinical use. Thus ether has the property of dissolving organic acids from a liquid, leaving the mineral acids in solution. It may thus be used for separating the lactic, butyric, and other acids from the hydrochloric acid; and if, in a liquid obtained from the stomach, it is found that ether removes the whole of the acids present, it may be concluded that no free hydrochloric acid is present. In many cases this conclusion would be an important one as a clear indication for a line of treatment. Dr. Leo has lately published a new method for the indication of free hydrochloric acid which may prove useful. Leo considers the case where it is only a question of the presence of free hydric chloride and of an acid phosphate. To a few drops of the stomach contents a pinch of carbonate of calcium is added. If the acidity, as tested by litmus-paper, disappears, only a free acid is present; but, if the liquid is still acid after the addition of the chalk, an acid salt is present. If, moreover, organic acids be present, they must be first removed by shaking with ether before the chalk is added. It does not seem that Leo's method is one that can be applied at the bedside, because the detection of free hydrochloric acid is chiefly requisite in those cases in which organic acids are also present, as in cases of dilated stomach. At present, indeed, a ready method, suitable in clinical practice for the detection of free hydrochloric acid in organic liquids, is a desideratum.

CHOLERA IN PERSIA. — A correspondent of the *Bulletin Medical*, writing from Teheran, says that cholera in a virulent form exists throughout the valley of the Euphrates, and it is feared that it will become epidemic in Persia.

CREMATION IN PARIS. — The cremation furnace in Père-la-Chaise Cemetery, in Paris, is now complete, says *The Medical Record*, and the prefect of the Seine has approved the scale of charge to be enforced thereat. The charge for the use of the cremation furnace is to be fifty francs, which sum includes the keeping in the columbarium of the funeral urn containing the ashes for a period of five years.

BICARBONATE OF SODIUM IN MILK. — Hitherto it has been deemed permissible to add soda bicarbonate to milk to assist in its preservation, but now the Council of Hygiene of the Seine has condemned the practice as one of danger. The transformation of milk-sugar into lactic acid, in milk so adulterated, gives rise to a lactate of soda which is purgative, and frequently a source of almost uncontrollable diarrhœa in infants: consequently the council, in its bulletin, decides that "soda shall no longer be permitted in milk, which is an aliment of the first order, and very often prescribed for invalids and children."

ELECTRICAL NEWS.

The Transmission of Visual Images by Electricity.

A FRENCH electrician endeavors to solve the question of seeing at a distance by electricity, by means of a combination consisting of a selenium cell, a gas-telephone, and revolving mirrors, forming a special apparatus which he designates a "phoroscope," and which he discusses in *La Lumière Electrique* as follows.

The question of seeing at a distance by electricity is governed by the two following fundamental principles. In order to get the impression of the form, outlines, and details of one or several objects, it is not necessary (1) that the eye should receive all the rays proceeding from it; (2) that it should receive, at the same time, the luminous rays necessary for vision.

Some very simple examples will demonstrate the first principle. We can see an object very clearly through wire gauze, and the image is perfect if the interstices are large and the wire fine. Carpets and mosaic seen at a certain distance do not seem to be formed of a number of parallel lines, nor by the juxtaposition of little stones. An engraving, a picture, or especially a chromo-lithograph, show at a distance no discontinuity in the work, although the engraving is composed of lines, and the chromo-lithograph of separate little dots. We see thus that it is possible to have a sufficiently clear

perception of an object by the vision of a system of more or less luminous lines forming a kind of pattern.

The second principle is quite as well known, and is deduced from the duration of the luminous impressions upon the retina, a period of about one-tenth of a second. A series of impressions succeeding one another in a very short time produces the effect of simultaneous impressions; and it follows, that, in order to perceive the image which we have called the pattern, it is sufficient to receive the luminous impressions of the different lines that constitute it in an interval of time less than one-tenth of a second.

It was by taking this principle as a basis that Lissajous studied from an optical point of view the vibratory movements of bodies. His experiments are so well known that we need not enter into them here. Lissajous's curves are produced in a rectangular portion of a picture. If, on the other hand, this object possesses the power of illumination, all the rays proceeding from the space occupied by the curve will, in an exceedingly short space of time, converge at one point after having been subjected to a double reflection on the mirrors of the two tuning-forks that were employed for this experiment.

We may substitute for these forks any movable system whatever, bearing a series of mirrors arranged in such a manner that the displacement of each of them brings upon the same straight line all the rays projected from a portion of an illuminated object. Let us suppose these mirrors to be placed on a circle turning upon an axis perpendicular to its plane, and each of them making a different angle near 90° with this plane. To each mirror there will be a corresponding series of parallel lines in the picture; and, if the rotation is sufficiently rapid, all the rays proceeding from the object represented in the picture will meet at the same time, in as short an interval of time as required. It is thus possible to bring to one point all the luminous rays proceeding from a pattern; and, each portion of the image thus producing its impression upon the retina in succession, it is sufficient that the interval in which these impressions succeed one another should be sufficiently short for them to be rendered simultaneous.

The transformation of the luminous waves into electric currents is performed by means of a radiophonic receiver forming part of an electric circuit. This receiver may be a cell of selenium, lampblack, hydrogenated palladium, etc., the resistance of which varies with the quantity of light received. The different portions of the pattern will act differently, according to the quantity of light emanating from them, and in an interval of time less than one-tenth of a second. The variations of resistance of the circuit will correspond to the image observed.

In order to solve the opposite problem, i.e., to produce this image from the circuit at the receiving station, the writer proposes to employ the gas-telephone, which is an instrument of extreme sensitiveness. It consists of an ordinary telephone in which the portion comprised between the plate, the bobbin, and the inner sides, is in communication with a gas-pipe. The vibrating membrane is pierced in the centre with a little hole, through which escapes the gas, which is lighted. This little flame will undergo a variation in brilliancy at each movement of the membrane, and it will produce a continuous succession of rays similar to those converging upon the radiophonic receiver. In order to show them, and form an image similar to the pattern, a system of mirrors is employed similar to that used at the first station, but acting in the reverse way. It is evident that these two apparatus must act synchronously, like the Hughes and Baudot regulators employed in telegraphy. Station 2 will reproduce upon a sheet the lines taken upon the image at Station 1.

To sum up, the operation of this theoretical "phoroscope," as it is called, is as follows. The different parts which have been described being properly combined, the image to be transmitted is broken up into a series of parallel lines, the different points of which act in succession upon a selenium cell, varying the intensity of the current connecting the two stations. These variations in electrical intensity are transformed by the gas-telephone into variations of luminous intensity, and the successive changes of brilliancy of the little flame are projected upon a sheet at points corresponding to the various points of this sheet. Theoretically, nothing can prevent this double transformation of luminous intensity into electric intensity, but the realization of the experiment is surrounded with difficulties which make us fear that it will be long before a practical phoroscope is produced; but this should not discourage enterprising and persevering physicists.

NOTES AND NEWS.

LYDIA W. SHATTUCK, for over forty years teacher of botany in Mount Holyoke Seminary, died recently at an advanced age.

— Professor Daniel Kirkwood, for many years a professor of astronomy in the Indiana State University at Bloomington, has removed his residence to near Riverside, in southern California.

— Dr. George M. Sternberg of the army will deliver a lecture before the Brooklyn Institute on Dec. 26. He has selected for his subject "The Methods of Research in Bacteriology," to be illustrated by living forms of bacterial life thrown upon the screen.

— C. F. Wheeler of Hubbardston, Mich., has been appointed assistant in the botanical department of the Experiment Station at the Michigan Agricultural College, in place of Eugene Davenport, who has been elected professor of agriculture in the same institution.

— At the Johns Hopkins University a society of medical students has been organized on the plan of those in Berlin, the object being to bring the men of the various departments into closer connection, to stimulate original research, and to protect the claims of priority of work done by the members.

— Mr. Austin Corbin's game-forest on Croydon Mountain, New Hampshire, has been enriched, says *The American Field*, by the arrival there last week of a carload of buffaloes, two elks, a moose, deer, and a small band of antelopes. The buffaloes were shipped from Winnipeg, Man., by Buffalo Jones, who herds them there.

— The great astronomical event of this month will be the total eclipse of the sun, Dec. 22. Various governments have sent out parties to observe the eclipse itself, the United States steamship "Pensacola" having taken a well-equipped party from the United States to St. Paul de Loando, on the west coast of Africa, for this purpose.

— The greatest depth found by Capt. Spratt in the western Mediterranean basin was between Sicily, Sardinia, and Africa (about 10,600 feet). According to *Nature*, recent measurements in the eastern basin by Commander Magnaghi of the Italian Navy have yielded, as maximum depth, 13,556 feet, between the Islands of Malta and Candia.

— A brief outline of the rapid advancement that the practical application of electricity has made in the last few years is presented in "Everybody's Hand-Book of Electricity," by Edward Trevert, published by Damrell & Upham, Boston. The book is a paper-covered twenty-five cent volume, and treats briefly of electricity and magnetism, dynamos, electric lamps and motors, electric railways, electric welding, measuring instruments, galvanic batteries, and electric bells. It also contains a good glossary of electrical terms, and some useful tables for incandescent wiring.

— In June of the present year a series of observations on the velocity of the wind at the top of the Eiffel Tower was commenced. For this purpose there was erected on the tower, at a height of 995 feet above the ground, an autographic anemometer, constructed by Messrs. Richard Brothers of Paris, another of these instruments being at the same time put up at a station situated 1,650 feet from the foot of the tower, the height in this case being about 69 feet above the ground. Up to the 1st of October last, *Engineering* states, complete observations had been obtained for 101 days; and from these it appears that, on an average, the velocity of the wind is about 3.1 times as great at the more lofty station as it is at the lower. Moreover, the breeze at the top is always fairly strong, as, during the whole of the summer months in which observations were taken, the average velocity of the breeze throughout any given day always exceeded 23 feet per second, and during 21 per cent of the whole period of the observations this average daily velocity was upwards of 33 feet per second. No great storm seems to have occurred during the time over which the observations extend, and we do not know the maximum wind-velocity registered during this time.

— It is said that roaches may be exterminated if a powder thoroughly mixed, consisting of 37 parts of borax, 9 parts of starch, and 4 parts of cocoa, is liberally sprinkled in the cracks and corners of their *rendezvous*.

— The following free course of educational lectures, especially designed to interest the teachers of New York City and vicinity, has been arranged for, and will be given in the Assembly Hall of the College for the Training of Teachers, 9 University Place, on successive Tuesday afternoons at 4 P.M., beginning on Jan. 7, 1890: Jan. 7, "Rousseau's Pedagogic Theories and their Influence upon Educational Method," by James MacAlister, Ph.D., superintendent of schools, Philadelphia; Jan. 14, "The Teacher and the Time," by Miss Caroline B. LeRow, author of "The Young Idea;" Jan. 21, "The Teaching of English Literature," by Truman J. Backus, LL.D., president of the Packer Collegiate Institute, Brooklyn; Jan. 28, "The Voice as an Element in School Management," by E. H. Cook, Ph.D., head master of the Rutgers College Grammar School, New Brunswick, N.J.; Feb. 4, "The Function of a National Bureau of Education," by William T. Harris, LL.D., United States commissioner of education; Feb. 11, "The Duty of the State in the Matter of Training Teachers," by W. H. Maxwell, Ph.D., superintendent of schools, Brooklyn; Feb. 18, "Higher Education in the State of New York," by Melvil Dewey, A.M., secretary of the University of the State of New York; Feb. 25, "Physical Training in the Public Schools," by Addison B. Poland, A.M., superintendent of schools, Jersey City, N.J.; March 4, "Inventional Geometry," by Edward R. Shaw, Esq., principal of the Yonkers (N.Y.) High School; March 11, "Suggestions in the Teaching of Color," by Mrs. Hannah Johnson Carter, professor of form study and drawing, New York College for the Training of Teachers; March 18, "Education in the Nineteenth Century," by Henry M. Leipziger, Ph.D., principal of the Hebrew Technical Institute, New York; March 25, "An Observation Lesson," by John F. Woodhull, A.B., professor of natural science, New York College for the Training of Teachers; April 1, "Form Study and Drawing, and their Relations to General Education," by Mrs. Mary Dana Hicks, director of Prang's normal drawing classes, Boston, Mass.

— Col. Woodthorpe recently delivered at Simla a lecture on the Aka Expedition of 1883. It may be remembered that this tribe, which inhabits the hills north of Assam, owing to some forest disputes and a supposed interference with their trade in rubber, seized two English forest officers, and carried them off. To recover these men, a small expedition was despatched, under the command of Col. Woodthorpe. The Aka houses, according to *Nature*, are built on piles raised above the ground, with a large space at one end, where the children play. The dress consists of a tunic of Tibetan cloth, and trousers, reaching to the feet, made of thin white material. Long trousers are worn to keep off the *damdum*, a troublesome little fly or mosquito. Bows and arrows, and knives with blades easily detachable from a bamboo handle, are the chief weapons. The barbs of the arrows are dipped in aconite, and are so treated, that, when any attempt is made to pluck out the arrow, the barb breaks off, and remains in the wound. The poison is so deadly, that even a buffalo usually falls, after running a few yards, when he has been struck by one. Some of the superstitions of the Akas are curious. If a river runs between an Aka's house and his burying-place, his soul can never go home after death. This inability of the spirit to cross water is, however, overcome, and every year Akas may be seen stretching a string across the stream that divides the grave from the house of the departed. The ghost can easily cross when the slightest foothold is given him.

— It is sometimes said about old trees (e.g., an old lime in the new Gardens at Potsdam) that the present branches are properly roots; and it has been reported that trees may be planted, and will grow, in the inverted position. A scientific inquiry into this matter has been made by Herr Kny, in Germany, taking a number of plants of wild vine (*Ampelopsis*) and ivy about 3.5 metres high. *Nature* states that in 1884 he planted these with both ends in the ground; and in the spring of 1885, after the tops had rooted, he cut the arch at its highest point. In the first year, two of the plants died, but the others (twelve vine and fourteen ivy) grew vigorously, and were still alive this last spring. To test the extent of the inversion, he cut slips from the inverted plants, and planted them in a greenhouse, some with their natural, and some with their artificial upper end uppermost. It appeared that the callus, from which the roots spring, was formed at both ends, but more readily at the naturally lower end, whether this was above or below, in the experiment. Herr Kny considers, that, notwithstanding several years' successful culture, the inversion was not thoroughly completed. He proposes to continue his investigation, and invites people who have gardens to make like experiments with other plants, recommending willows, poplars, and roses.

— Dr. Quesneville, the French chemist, died on Nov. 14, at the age of eighty. He took his degree of doctor of medicine in 1834, having studied chemistry under Chevreul. In 1840 he started the *Revue Scientifique*, a monthly periodical, which he afterwards called the *Moniteur Scientifique*. This periodical came to an end in October last, Dr. Quesneville explaining that the task was rendered too severe by the infirmities of old age.

— Professor Meiklejohn has been lecturing at Perth, Scotland, on literature *versus* books, and, after an able and humorous dissertation, concluded by assuring his hearers that they had thousands of teachers, but what they needed to be taught most was to feel. Let them resolve to read as little as they possibly could, and to re-read what was the best, what was worth storing in our memory, what was worth learning by heart. Let them shun the stupefying influence of the modern demand for aimless, promiscuous, debilitating, and vapid reading. Let them look for that which forms, sustains, and perennially delights. Clear feeling, deep enjoyment, were what they wanted. With these they had literature; without these they had only a semblance of speech. Let them in literature shun mere acquaintances: let them form friendships. No man could expect to have a hundred friends; and so no man, especially in these crowded times, could know thoroughly and well more than five or six good books.

— According to a circular which has recently been sent to the leading physicists, electricians, and others interested in the history of English science, it is proposed to establish a Gilbert club, the inaugural meeting of which was convened Nov. 28 in the rooms of the Society of Arts, London, at 4.30 P.M. The object of the club, as we learn from *Nature*, is to do justice to the memory of the illustrious president of the College of Physicians, who was in the possession of, and was actually carrying on, the true experimental method of scientific inquiry at a time when Bacon was only talking and writing about it. There can be no doubt that the claims of William Gilbert of Colchester have been to a great extent overshadowed by the fame of the renowned lord-chancellor, and it is much to be regretted that we have not had handed down to us more of the results of Gilbert's labors than are to be found in his celebrated work "De Magnete," published in the year 1600. Such as it is, this work may, however, be justly regarded as the earliest English scientific classic, and its author must be recognized as the first truly philosophical investigator in the now all-important subjects of electricity and magnetism. The club has been organized for the object of bringing out an English edition of "De Magnete," as nearly as possible in the style of the original folio edition, and to arrange for a befitting celebration of the tercentenary of this work in the year 1900. To quote the circular, "The publication of 'De Magnete' not only marked an epoch in the science of magnetism, but constituted the absolute starting-point of the science of electricity. It has been hitherto a reproach to British electricians that they too little recognized the merits of the founder of the science." The preliminary list of members already includes the names of Sir William Thomson, Lord Rayleigh, Professor Tyndall, Sir John Lubbock, Professor Rücker, Professor Lodge, Mr. Preece, Professor Reinold, Professor Perry, Professor G. Forbes, Professor D. E. Hughes, Sir F. A. Abel, Sir F. Bramwell, Sir Douglas Galton, Sir H. Mance, Col. Festing, Capt. Abney, Professor Carey Foster, Professor W. G. Adams, Professor J. C. Adams, Professor Roberts-Austen, Professor Thorpe, Professor G. H. Darwin, Professor Liveing, Professor Dewar, Professor W. N. Shaw, Professor Poynting, Professor Ray Lankester, Mr. Crookes, Mr. J. Hopkinson, Mr. Glazebrook, Mr. G. J. Symons, Dr. J. H. Gladstone, Dr. B. W. Richardson, Professor Victor Horsley, Mr. Latimer Clark, etc.

— The fifth winter meeting of the Indiana Academy of Science will be held at Indianapolis, Dec. 30 and 31. It is desired that the first session convene at 10 A.M., Dec. 30. At the coming meeting a part of the work will be done in sections, of which two are to be organized: A, Zoology, Botany, Geology, and Geography; B, Chemistry, Physics, and Mathematics. The programme committee is composed of John M. Coulter, chairman, Crawfordsville, Ind.; and W. V. Brown, Greencastle, Ind.

— The production of essential oil of geranium in the island of Re-union in the Indian Ocean is assuming considerable proportions. The exports in 1887 were 2,786 pounds; and in 1888, 3,992 pounds; while during the present season they are estimated at 5,720 pounds; and for 1890, the plantations having been largely extended, at 13,000 pounds or more. The new flowers are now being distilled. In Africa, on the other hand, this season's yield of geranium-oil is said to have been much below the average.

— Early last month the newly appointed occupant of the Greek chair at Glasgow University, Professor Murray, delivered his introductory address in the Bute Hall of the college, before a very large attendance of students and the general public. Taking for his subject, as we learn from *The Educational Times*, "The Place of Greek in Education," Professor Murray said that the old classical system of education was attacked by two diverse enemies, — one what they might call the cultivated standpoint, and the other the mercantile standpoint. Those who led the battle from the cultivated or scientific standpoint would say, "Why should a boy spend all his time on one comparatively small branch of knowledge?" while the other enemy which classics had would think as follows: "Greek and Latin are dead languages. No one travelling abroad wants to speak them; no house of business will engage a clerk because he can write Greek; no great inventions, no railway or electric light, ever came from a knowledge of Greek; no great fortune was ever made by a knowledge of Greek." These two criticisms were of exactly opposite kinds. The former — the strength of which seemed to him irresistible, and he would not, if he could, battle with it — sought for a fuller and better education: the latter was the secret enemy of any education at all. He would point out, however, that as all departments of knowledge were equally honorable in themselves, and all equally deserved to be studied, so, on the other hand, they could not possibly be all studied by the same people. Some few subjects ought to be studied by everybody. He did not think Greek was one of them. Greek was a language of unusual difficulty, and a man could undoubtedly reach very high points of culture without any knowledge of Greek; but for the student of history, of political philosophy, of ethics, of logic, of archæology, and also for the student of most forms of art, the floods of light that ancient Greece could shed upon these subjects were something incalculable and beyond price. Heaven forbid that he should unduly magnify his office or cry up his wares in the spirit of a charlatan, but he believed that there was but one nation, uniquely gifted and uniquely interested, to be found in all the annals of mankind; and if they were to choose some one period of history, some one department of the great world of knowledge, to educate their youth with, he believed, that, for those minds which were naturally attracted to it, the study of Greece was an education as full and as stimulating as lay within man's reach at the present time.

— One of the most interesting and valuable results of recent French horticultural effort is found in the new race of dwarf cannas, with large and brilliantly colored flowers, produced by M. Crozy of Lyons. A large bed of these plants in the garden of the Trocadéro, in Paris, was surrounded all summer by crowds of people. Too much has not been said of the beauty of these plants, and of their value for decorative purposes, whether planted in the open ground or grown in pots or tubs. The colors of the flowers of some of the varieties, says *Garden and Forest*, are surprisingly brilliant. There seems no good reason, however, for calling the plants "dwarf," except that they begin to flower when they are not more than twenty inches high; for they grow, especially in this country, when generously treated, to a height of six or eight feet. Seventeen of the new varieties exhibited at Paris for the first time (which, on the whole, are no better than those sent out by M. Crozy during the past two years) are described in a recent issue of the *Revue Horticole*. No one who has not seen a collection of M. Crozy's cannas in good condition can form the faintest idea even of the beauty and the brilliancy of the flowers of the plants.

— From a thousand prune-trees five years old, Capt. Guy E. Grosse of Santa Rosa, Cal., has this season dried five tons of fruit, which he is delivering, according to *Garden and Forest*, at the Southern Pacific station for eastern shipment at four and a half cents a pound. The rapid maturing of a prune-orchard, after arriving at the fourth year, is shown by the increase in the crop of this year over that of last year, when the yield was but twelve hundred pounds. Next year it is expected the crop will be trebled. At four and a half cents a pound, the proceeds from the thousand trees this year equals four hundred and fifty dollars. In two years more it should be nearly three thousand dollars.

— The registrations of the sunshine recorder at Ben Nevis Observatory, according to a report read at the British Association at Newcastle, showed 970 hours of sunshine during the year; the smallest number of hours for any month being 8 for November, and the largest 250 in June, being nearly half the possible sunshine. The numbers of hours for the four years now observed, beginning with 1885, were 680, 576, 898, and 970. The contrast of the sunshine of 1886 with that of 1888 is thus very striking. The amount of the rainfall for the year was 132.46 inches; the month of least rainfall (3.76 inches) being June, and the greatest (20.60 inches) being November. The number of days on which precipitation was *nil*, or less than the hundredth of an inch, was 118. The numbers of rainless days for the last three years have been 159, 128, and 118. From all the observations yet made, it is seen that a fall equalling at least one inch a day has occurred on an average of one day in nine. Atmospheric pressure was this year again above the annual average, the mean level being 29.889, or .055 higher. The lowest mean at the observatory (25.035 inches) occurred in March, and the highest (25.595 inches) in September, the difference being .555 of an inch. At sea-level at Fort William, the extreme monthly means were 29.636 inches in November, and 30.132 in September, the difference being .496 of an inch.

— Some investigations have lately been made into the question of the vibration in buildings caused by machinery in motion. These were made in connection with the Westinghouse engine, in cases where it was necessary to place engines of this type on upper floors. The theory based upon these investigations is, that, if the slight motion which every engine has is exactly in time with the natural vibration of the floor-beam, each pulsation of the engine will increase the scope of the vibration of the floor, resulting in a most disastrous shaking; while, if the pulsations of the engine are in discord with the floor, comparative quiet will exist. As floor-beams are usually long, and their time of vibration correspondingly long, it is usually found that a fast-running engine will give less of its vibration to the floor-beams than a slow-running one. It is also worthy of note that the vibrations of a fast-running engine are more numerous and less forcible, hence easier resisted by the mass of the floor. An interesting example of preventing vibration by discord was shown in the case, reported in *The Railroad and Engineering Journal*, of a Westinghouse 10 horse-power engine, which, on an upper story of a silverware-manufactory, created such a commotion as to rattle the silverware on the shelves a hundred feet distant. A change of 25 revolutions, increasing the speed, entirely stopped the vibrations. In another case — the factory of Arbuckle Brothers in Brooklyn — two Westinghouse engines of 125 horse-power each, and one of 45 horse-power, are located on the fifth floor. These engines were erected on the heavy floor-timbers, the floor-boards being cut away, and extra timbers being inserted between the joists. Across said timbers were placed oak stringers, which have been seasoning since the war in some unfinished vessels in the Brooklyn Navy Yard. On these the engines were mounted with plain fly-wheels, and experiments were conducted to determine the speed at which it would be best to run. It was found that at 204 revolutions the vibration was at the minimum, and was very slight, being as little as that caused by any of the ordinary driven machinery. The speed was therefore fixed at this point, and the wheels then made to give the proper belt speed.

— The annual reports of the superintendents of the several fish-hatcheries (six in number) were made at a meeting of the commissioners recently held in New York, as reported in *The American Field*, and show great prosperity and efficiency. The distribution of fry last year exceeded twenty millions in number, and the supply of spawn for this winter's operations is larger than in any previous year. Six millions of salmon-trout eggs have been gathered at the upper Great Lakes. The Adirondack, Fulton Chain, and Sacondaga hatcheries have collected from the wild trout of their respective localities all that their troughs will contain, besides the large supply of salmon-trout eggs to be hatched. At Caledonia one hundred thousand are taken daily by stripping the stock fish. The commission will this year work the private hatchery of M. B. Hill at Clayton. Here wall-eyed pike, whitefish, and siscoes are to be hatched. At the Chautauqua Lake station experiments are to be continued with muscalonge. The three Adirondack hatcheries have now an output sufficient for all the accessible wilderness region, leaving the large production of Caledonia principally for the supply of the Catskill, Beaverkill, Neversink, and upper Delaware regions, which are so much frequented by tourists. An additional shad-hatching station is to be established on the Hudson River, so that the supply of this choice market fish may be increased. It is expected that the total output of fry of all kinds next year will be fully thirty millions.

— Experiments have been made recently in this city and Newark with a South American bean called the "angola," with the view of substituting it for gambier, but the *Oil, Paint, and Drug Reporter* announces that the tests were not satisfactory. This new material has been offered at one cent per pound less than gambier, and New Jersey tanners imagined that they had been put in possession of a valuable addition to their raw materials until the trials demonstrated that gambier could not be substituted so easily. The importation of the peculiar beans has practically ceased in consequence, and South American houses have been requested to pursue their investigations further, in the hope of obtaining some new product which would be of value in this line, as there are times when it is desired to prevent the fluctuations in gambier by pushing an article to take its place. Some attention is being directed to canaigre-root, which was described in the *Reporter* of Sept. 4, but great difficulty has been experienced in obtaining supplies from Mexico. The inquiries come from tanners, but thus far they have not been satisfied; and it is questionable if a cheaper article than gambier can be found to meet the same requirements.

— Mr. H. L. Bolley, in a bulletin of the Agricultural Experiment Station of Indiana, arrives at the following conclusions regarding wheat-rust: 1. The rusting of wheat is due to the attacks of several species of minute fungi. 2. The disease is propagated by means of various spores, one form of which is developed upon various determined and undetermined plants, mostly weeds. This side form is not as yet proved to be essential to the continued life of the parasites, but its destruction decreases the danger from serious attacks of the disease. 3. One species (*P. rubigo-vera*), in its uredo stage, is able to pass the winter in the tissues of the young wheat-plant. 4. In warm weather any conditions of the soil or atmosphere which tend to keep the wheat-leaves constantly wet are conducive to the rapid spread of the disease. 5. Low-lying, rich soils are most subject to the disease. 6. No variety of wheat is known to be rust-proof, yet some possess greater powers of resistance than others. 7. Though not proved, an excess of nitrogen in the soil is to be considered probably as liable to produce wheat easily affected by rust. If fertilizers are to be applied to such lands, those containing only inorganic elements are most advantageous, so far as immunity against rust is concerned. 8. In districts liable to severe visitations of the disease, early-ripening wheats are to be preferred.

— The *Deli Courant* states that search for petroleum along the banks of the Lepan River, in Langkat, in Netherlands-India, has resulted in the discovery of large deposits of that oil. Raw petroleum oozes out of the ground at many places where the natives have consequently dug pits. The output from most of the latter has never been considerable, and shows fluctuation. At Telega Tunggal, where the boring reached a depth of about three hundred and fifty feet, more important results have been arrived at. Appearances indicate that the main reservoir has been tapped there. The oil met with in the other pits and deposits proved to have found its way above ground from that storing-place. The oil tested yields thirty-five per cent of lamp-oil of good quality. It does not contain harmful ingredients, and offers advantages as a lubricator. The exact depth of the other deposits remains to be determined before an estimate of working expenses can be accurately made.

— The fifteenth annual meeting of the New Jersey State Horticultural Society will be held at Trenton on Wednesday and Thursday, Dec. 18 and 19.

— A very important announcement is made in the *Medical and Surgical Reporter* in regard to the University of Pennsylvania; namely, that Dr. John S. Billings has, with the approval of the secretary of war and of the surgeon-general, accepted the position of medical director of the University Hospital, to which he was recently elected, and that the duties of this new position will be so arranged as not to interfere with his duties as medical officer of the army at the surgeon-general's office. It is also announced that the University of Pennsylvania is soon to have a new laboratory of hygiene, to cost about $200,000, and that $100,000 have been already collected for this purpose. The department of hygiene has been under the supervision of Dr. Samuel G. Dixon since the death of Dr. N. A. Randolph, who was recently one of the editors of the *Medical and Surgical Reporter*. It was rumored at first that Dr. Billings was to supersede Dr. Dixon; but the provost of the university promptly denied this rumor, and stated that Dr. Dixon was still professor of hygiene in the university, and in charge of the laboratory of hygiene, which has been equipped through his exertions and liberality. It does not yet appear just what Dr. Billings will do at the university, but the probability is that he will be at the head of the department of hygiene. For this he is abundantly fitted, as he is recognized as an authority upon the subjects of hygiene and hospital construction and administration. The elaboration of the plans for the construction of the Johns Hopkins Hospital, and his coming, will be a valuable accession to the teaching force of the University of Pennsylvania.

— The Glendon Iron Company of Easton, Penn., operating one of the largest blast-furnaces on the Atlantic coast, have for a number of years followed a somewhat novel plan of getting out their limestone for furnace purposes. Their quarry, located at Glendon, Penn., has a perpendicular face, varying from 120 to 160 feet in height; and instead of drilling down a few feet back from the face of the quarry at the top, and taking the stone off in benches, as is done in other quarries in the East, they drive a tunnel back at the foot of the quarry, and from that horizontally in both directions on a parallel line with the base. The powder is loaded in chambers located in this latter tunnel, and sunk a few feet below the base-level. The tunnels are then filled up to the opening, and the explosives fired by electricity, Such a blast as this was fired with most successful results on the 27th of September last, and, as described in *The Engineering and Mining Journal*, it appears that the tunnel from the face-line was driven directly back 50 feet, the length of the horizontal tunnel being 135 feet. Four chambers were located on this tunnel 5 feet deep, the diameters being from 4 × 6 to 4 × 7 feet. In these was loaded Judson R. R. P. powder, divided respectively into lots of 8,000, 5,000, 3,000, and 4,000 pounds. The blast was fired by the superintendent of the Glendon Iron Company, Mr. M. P. Janney, and it was estimated that 60,000 tons of limestone were dislodged. About once each year this company fire one of these blasts, having always met with uniform success. While the cost of Judson powder is somewhat higher than that of black powder, the smaller quantity required, and the fact that it breaks the stone up finer, making it easier to handle, and requiring less drilling for block-holing, show a decided economy in its favor. On the Pacific coast this method of tunnelling beneath the burden, and firing in large charges, is generally adopted by railroad contractors and others, where large quantities of earth or rock are to be removed; but, with the exception of the Glendon Quarry, we do not know that the plan has come into vogue in the eastern part of the United States.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....$3.50 a year.
Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XIV. NEW YORK, DECEMBER 13, 1889. No. 358

CONTENTS:

A NEW DYNAMO AND PROJECTOR... 397
TWENTY YEARS. 398
HEALTH MATTERS.
Ozone in the Treatment of Phthisis 400
New Jersey Sanitary Association.. 400
High Altitude Treatment of Phthisis 401
The Acids of the Stomach..... ... 401
Cholera in Persia 401
Cremation in Paris..... 401
Bicarbonate of Sodium in Milk..... 401
ELECTRICAL NEWS.
The Transmission of Visual Images by Electricity..... 401
NOTES AND NEWS..... 402
ANCIENT ARABIA *A. H. Sayce* 406
MR. MACKINDER ON GEOGRAPHY-TEACHING 408
SPEED OF RAILROAD TRAINS IN EUROPE 409
AMONG THE PUBLISHERS..... . .. 409
LETTERS TO THE EDITOR.
A Belated Dandelion *E. B. Knerr* 412
Is Man Left-Legged? *F. A. Lovejoy; F. H. Allen* 412
INDUSTRIAL NOTES.
The Crocker-Wheeler Electric Motor..... 412

ANCIENT ARABIA.[1]

IF there is any country which has seemed to lie completely outside the stream of ancient history, it is Arabia. In spite of its vast extent; in spite, too, of its position in the very centre of the civilized empires of the ancient East, midway between Egypt and Babylon, Palestine and India, — its history has seemed almost a blank. For a brief moment, indeed, it played a conspicuous part in human affairs, inspiring the Koran of Mohammed, and forging the swords of his followers; then the veil was drawn over it again, which had previously covered it for untold centuries. We think of Arabia only as a country of dreary deserts and uncultured nomads, whose momentary influence on the history of the world was a strange and exceptional phenomenon.

But the restless spirit of modern research is beginning to discover that such a conception is wide of the truth. The advent of Mohammed had long been prepared for. Arabia had long had a history, though the records of it were lost or forgotten. The explorer and decipherer have been at work during the last few years; and the results they have obtained, fragmentary though they still may be, are yet sufficiently surprising. Not only has Arabia taken its place among the historical nations of antiquity, its monuments turn out to be among the earliest relics of alphabetic writing which we possess.

Arab legend told of the mysterious races of 'Ad and Thamud, who, in the plenitude of their pride and power, refused to listen to the warnings of the prophets of God, and were overwhelmed by divine vengeance. In the south the magnificent palaces of 'Ad might still be seen in vision by the belated traveller, while the rock-cut dwellings of Thamud were pointed out among the cliffs of the north; but the first authentic information about the interior of Arabia came to Europe from the ill-fated expedition of Ælius Gallus, the Roman governor of Egypt, in B.C. 24. The spice-bearing regions of southern Arabia had long carried on an active trade with East and West, and the wealth their commerce had poured into them for centuries had made them the seats of powerful kingdoms. Their ports commanded the trade with India and the further East. Already in the tenth chapter of Genesis we learn that Ophir, the emporium of the products of India, was a brother of Hazarmaveth or Hadramaut. Western merchants carried back exaggerated reports of the riches of "Araby the Blest," and Augustus coveted the possession of a country which commanded the trade with India as well as being itself a land of gold and spicery. Accordingly, with the help of the Nabatheans of Petra, a Roman army was landed on the western coast of Arabia, and marched inland as far as the kingdom of Sheba or the Sabæans. But disease decimated the invaders, their guides proved treacherous, and Ælius Gallus had to retreat under a burning sun and through a waterless land. The wrecks of his army found their way with difficulty to Egypt, and the disaster made such an impression at Rome that the conquest of Arabia was abandoned forever. From that time forward to the rise of Mohammedanism, the Roman and Byzantine courts contented themselves with supporting the native enemies of the Sabæan kings, or using Christianity as a means for weakening their power.

As far back as 1810, Seetzen, while travelling in southern Arabia, discovered and copied certain inscriptions written in characters previously unknown; later travellers brought to light other inscriptions of the same kind; and eventually, with the help of an Arabic manuscript, the inscriptions were deciphered, first by Gesenius, and then by Roediger (1841). They received the name of "Himyaritic" from that of the district in which they were found, — Himyar, the country of the Homerites of classical geography. The language disclosed by them was Semitic, while their alphabet was closely related to the so called Ethiopic or Geez. In certain dialects still spoken on the southern Arabian coast, notably that of Mahrah, between Hadramaut and Oman, the peculiarities of the old Himyaritic language are still to be detected.

In 1841 Arnaud succeeded, for the first time, in penetrating inland to the ancient seat of the Sabæans, and in bringing back with him a large spoil of important inscriptions. Later, in 1869, another adventurous jonrney was made by M. Halévy, on behalf of the French Academy, who was rewarded by the discovery of more than 800 texts. But it is to Dr. Glaser that we owe the better part of our present knowledge of the geography and ancient history of southern Arabia. Three times, at the risk of his life, he has explored a country of which our modern geographers still know so little, and, almost alone among Europeans, has stood among the ruins of Mârib, or Mariaba, called by Strabo the Metropolis of the Sabæans. He has collected no less than 1,031 inscriptions, many of them of the highest historical interest. The first-fruits of his discoveries have been published in his "Skizze der Geschichte Arabiens," of which the first part has just appeared at Munich.

For some time past it has been known that the Himyaritic inscriptions fall into two groups, distinguished from one another by phonological and grammatical differences. One of the dialects is philologically older than the other, containing fuller and more primitive grammatical forms. The inscriptions in this dialect belong to a kingdom the capital of which was at Ma'in, and which represents the country of the Minæans of the ancients. The inscriptions in the other dialect were engraved by the princes and people of Sabâ, the Sheba of the Old Testament, the Sabæans of classical geography. The Sabæan kingdom lasted to the time of Mohammed, when it was destroyed by the advancing forces of Islam. Its rulers for several generations had been converts to Judaism, and had been engaged in almost constant warfare with the Ethiopic kingdom of Axum, which was backed by the influence and subsidies of Rome and Byzantium. Dr. Glaser seeks to show that the founders of this Ethiopic kingdom were the Habâsa, or

[1] From the Contemporary Review for December.

Abyssinians, who migrated from Himyar to Africa in the second or first century B.C. When we first hear of them in the inscriptions, they are still the inhabitants of northern Yemen and Mahrah. More than once the Axumites made themselves masters of southern Arabia. About A.D. 300 they occupied its ports and islands, and from 350 to 378 even the Sabæan kingdom was tributary to them. Their last successes were gained in 525, when, with Byzantine help, they conquered the whole of Yemen. But the Sabæan kingdom, in spite of its temporary subjection to Ethiopia, had long been a formidable state. Jewish colonies settled in it, and one of its princes became a convert to the Jewish faith. His successors gradually extended their dominion as far as Ormuz, and, after the successful revolt from Axum in 378, brought not only the whole of the southern coast under their sway, but the western coast as well, as far north as Mecca. Jewish influence made itself felt in the future birthplace of Mohammed, and thus introduced those ideas and beliefs which subsequently had so profound an effect upon the birth of Islam. The Byzantines and Axumites endeavored to counteract the influence of Judaism by means of Christian colonies and proselytism. The result was a conflict between Sabâ and its assailants, which took the form of a conflict between the members of the two religions. A violent persecution was directed against the Christians of Yemen, avenged by the Ethiopian conquest of the country and the removal of its capital to San'a. The intervention of Persia in the struggle was soon followed by the appearance of Mohammedanism upon the scene, and Jew, Christian, and Parsi were alike overwhelmed by the flowing tide of the new creed.

The epigraphic evidence makes it clear that the origin of the kingdom of Sabâ went back to a distant date. Dr. Glaser traces its history from the time when its princes were still but *Makârib*, or "priests," like Jethro the priest of Midian, through the ages when they were "kings of Sabâ," and later still "kings of Sabâ and Raidân," to the days when they claimed imperial supremacy over all the principalities of southern Arabia. It was in this later period that they dated their inscriptions by an era, which, as Halévy first discovered, corresponds to 115 B.C. One of the kings of Sabâ is mentioned in an inscription of the Assyrian king Sargon (B.C. 715), and Dr. Glaser believes that he has found his name in a "Himyaritic" text. When the last priest, Samah'alî Darrahh, became king of Sabâ, we do not yet know; but the age must be sufficiently remote, if the kingdom of Sabâ already existed when the Queen of Sheba came from Ophir to visit Solomon.

The visit need no longer cause astonishment, notwithstanding the long journey by land which lay between Palestine and the south of Arabia. One of the Minæan inscriptions discovered by Dr. Glaser mentions Gaza; and we now have abundant evidence, as we shall see, that the power and culture of the Sabæans extended to the frontiers of Edom. From the earliest times the caravans of Dedan and Tema had traversed the highways which led from Syria to the spice-bearing regions of Yemen. Three thousand years ago it was easier to travel through the length of Arabia than it is to-day. A culture and civilization existed there of which only echoes remain in Mohammedan tradition.

As we have seen, the inscriptions of Ma'in set before us a dialect of more primitive character than that of Sabâ. Hitherto it has been supposed, however, that the two dialects were spoken contemporaneously, and that the Minæan and Sabæan kingdoms existed side by side. But geography offered difficulties in the way of such a belief, since the seats of Minæan power were embedded in the midst of the Sabæan kingdom, much as the fragments of Cromarty are embedded in the midst of other counties. Dr. Glaser has now made it clear that the old supposition was incorrect, and that the Minæan kingdom preceded the rise of Sabâ. We can now understand why it is that neither in the Old Testament nor in the Assyrian inscriptions do we hear of any princes of Ma'in; and that, though the classical writers are acquainted with the Minæan people, they know nothing of a Minæan kingdom.[1] The Minæn kingdom, in fact, with its culture and monuments, the relics of which still survive, must have flourished in the gray dawn of history, at an epoch at which, as we have hitherto imagined, Arabia was the home only of nomad barbarism; and yet in this remote age alphabetic writing was already known and practised, the alphabet being a modification of the Phœnician written vertically and not horizontally. To what an early date are we referred for the origin of the Phœnician alphabet itself!

The Minæan kingdom must have had a long existence. The names of thirty-three of its kings are already known to us, three of them occurring not only on monuments of southern Arabia, but on those of northern Arabia as well.

Northern Arabia has been as much a *terra incognita* to Europeans as the fertile fields and ruins of Arabia Felix. But here, too, the veil has been lifted by recent exploration. First, Mr. Doughty made his way to the ruins of Teima, the Tema of the Bible (Isa. xxi. 14; Jer. xxv. 23; Job vi. 19), and the rock-cut tombs of Medain Salihh, wandering in Bedouin dress, at the risk of his life, through a large part of central Arabia. He brought back with him a number of inscriptions, which proved that this part of the Arabian continent had once been in the hands of Nabatheans who spoke an Aramaic language, and that the Ishmaelites of Scripture, instead of being the ancestors of the tribe of Koreish, as Mohammedan writers imagine, were an Aramæan population, whose language was that of Aram, and not of Arabia. The Sinaitic inscriptions had already shown that in the Sinaitic peninsula Arabic is as much an imported language as it is in Egypt and Syria. There, too, in pre-Christian times, inscriptions were engraved upon the rocks in the Nabathean characters and language of Petra, — inscriptions in which a fertile imagination once discovered a record of the miracles wrought by Moses in the wilderness.

Since Mr. Doughty's adventurous wanderings, Teima and its neighborhood have been explored by the famous German epigraphist, Professor Euting, in company with a Frenchman, M. Huber. M. Huber's life was sacrificed to Arab fanaticism, but Professor Euting returned with a valuable stock of inscriptions. Some of these are in Aramaic Nabathean, the most important being on a stêlê discovered at Teima, which is now in the Museum of the Louvre. About 750 are in an alphabet and language which have been termed "Proto-arabic," and are still for the most part unpublished. Others are in a closely allied language and alphabet, called "Lihhyanian" by Professor D. H. Müller, since the kings by whose reigns the inscriptions are dated are entitled kings of Lihhyân, though it is more than probable that Lihhyân represents the Thamud of the Arabic genealogists. The rest are in the language and alphabet of Ma'in, and mention Minæan sovereigns, whose names are fouud on the monuments of southern Arabia.[1]

The Minæan and Lihhyanian texts have been mainly discovered in El-Ola and El-Higr, between Teima and El-Wej, — a port that until recently belonged to Egypt, — on the line of the pilgrims' road to Mecca. The Proto-arabic inscriptions, on the other hand, are met with in all parts of the country, and, according to Professor Müller, form the intermediate link between the Phœnician and Minæan alphabets. Like the Lihhyanian, the language they embody is distinctly Arabic, though presenting curious points of contact with the Semitic languages of the north; as, for example, in the possession of an article *ha*. The antiquity of Lihhyanian writing may be judged from the fact that Professor Müller has detected a Lihhyanian inscription on a Babylonian cylinder in the British Museum, the age of which is approximately given as 1000 B.C.

We gather, therefore, that, as far back as the time of Solomon, a rich and cultured Sabæan kingdom flourished in the south of Arabia, the influence of which, if not its authority, extended to the borders of Palestine, and between which and Syria an active commercial intercourse was carried on by land as well as by sea. The kingdom of Sabâ had been preceded by the kingdom of Ma'in, equally civilized and equally powerful, whose garrisons and colonies were stationed on the high-road which led past Mecca to the countries of the Mediterranean. Throughout this vast extent of territory alphabetic writing in various forms was known and practised, the Phœnician alphabet being the source from which it was

[1] It is possible that a Minæan population is meant by the Maonites of Judges x. 12, the "Mehunims" of 2 Chron. xxvi. 7.

[1] The Minæan and Lihhyanian texts have been edited and translated, with an important introduction, by Professor D. H. Müller: "Epigraphische Denkmäler aus Arabien," in the "Denkschriften d. K. Akademie d. Wissenschaften zu Wien," vol. xxxvii., 1889.

derived. The belief, accordingly, that pre-Mohammedan Arabia was a land of illiterate nomads, must be abandoned: it was not Islam that introduced writing into it, but the princes and merchants of Ma'in and Thamud, centuries upon centuries before. If Mohammedan Arabia knew nothing of its past, it was not because the past had left no records behind it.

A power which reached to the borders of Palestine must necessarily have come into contact with the great monarchies of the ancient world. The army of Ælius Gallus was doubtless not the first which had sought to gain possession of the cities and spice-gardens of the south. One such invasion is alluded to in an inscription which was copied by M. Halévy. The inscription belongs to the closing days of the Minæan kingdom, and after describing how the gods had delivered its dedicators from a raiding attack on the part of the tribes of Sabâ and Khaulân, or Havilah, goes on to speak of their further deliverance from danger in "the midst of Misr," or Egypt, when there was war between the latter country and the land of Mazi, which Dr. Glaser would identify with the Edomite tribe of Mizzah (Gen. xxxvi. 13). There was yet a third occasion, however, on which the dedicators had been rescued by their deities 'Athtar, Wadd, and Nikrâhh: this was when war had broken out between the rulers of the south and of the north. If the rulers of the south were the princes of Ma'in, whose power extended to Gaza, the rulers of the north ought to be found in Egypt or Palestine. Future research may tell us who they were and when they lived.

But the epigraphy of ancient Arabia is still in its infancy. The inscriptions already known to us represent but a small proportion of those that are yet to be discovered. Vast tracts have never yet been traversed by the foot of an explorer, and there are ancient ruins which have never yet been seen by the eye of the European. What has been accomplished already with the scanty means still at our disposal is an earnest of what remains to be done. The dark past of the Arabian peninsula has been suddenly lighted up; and we find that long before the days of Mohammed it was a land of culture and literature, a seat of powerful kingdoms and wealthy commerce, which cannot fail to have exercised an influence upon the general history of the world. A. H. SAYCE.

MR. MACKINDER ON GEOGRAPHY-TEACHING.

THE reader in geography in the University of Oxford has been delivering a course of four lectures at the English College of Preceptors. The introductory lecture was given on Nov. 8, before a crowded audience, consisting mainly of women teachers.

We must first settle, said Mr. Mackinder (as given in the London *Journal of Education* of recent date), what are our aims in geographical teaching, else we shall be like men blindfold, trying to find their way out of a field with but one gate. If we succeed, it will be by a *θεία τύχη*. All teaching aims at discipline, or information, or both. Geography, as hitherto taught, has aimed solely at information. Even the leading authorities have supported this view. Thus a general, a distinguished member of the Geographical Society, lately complained to the lecturer of the brutal ignorance displayed by society in general, because at a large dinner-party his wife was the only guest who knew where Nassau, New Providence, was. Such geographical lore the lecturer said he heartily despised. It might have been of use before the invention of gazetteers: now it is utterly useless. Yet some geographical information is worth having, though discipline is the main thing, Thus the question turns up, "Where is Allahabad?" A reference to the gazetteer will tell us, "Allahabad is the capital of the North-West Provinces of India, situate at the junction of the Jumna and the Ganges." To the uneducated person these statements will convey nothing more than the vague impression that Allahabad is somewhere in the north of India. One who has been trained in geography will at once picture to himself the centre of a great and populous province, standing in the great plain which lies at the foot of the Himalayas. If the teacher has thus given a skeleton into which details may be fitted, he has not merely supplied information, but also developed capacity. Acquaintance with great facts, vividly and familiarly known, so that they are part and parcel of the mind's furniture, is indeed discipline; for it involves the grasping of contrasts, analysis, learning to deal with ideas.

The basis of geography-teaching must undoubtedly be *Heimatskunde* ("knowledge of the pupil's home and surroundings"); but this sound pedagogic principle has of late been pressed to the verge of absurdity. Professor Geikie, in "The Teaching of Geography," went so far as to leave all the geography out, and teach every thing else under the sun. We are told that the professor must teach his class the homologies of the limbs of animals, and the various styles of architecture. Such general knowledge is most valuable, but there is a danger of not seeing the wood for the trees. In the same way, if the reform advocated for elementary schools to combine geography and natural science were carried, geography would be pretty certain to go to the wall. True, geography, with one exception, is a late subject, and must be based on physiography; but it is best to keep the two names separate. "Physiography" is an old term, brought into fashion again by Professor Huxley. The Science and Art Department has just given it a more extended meaning than it bears in Professor Huxley's book with that title, and includes under its astronomical phenomena the laws of gravitation, etc. Such physiography we do not need as a preparation for geography. All a child need know is the meaning of the common world around him, the air he breathes, the water he drinks, ice, snow, rain, clouds. These facts of common life might be imparted at a very early age, and were best imparted by parents. At present parents are too ignorant to teach them, and they must be taught first at school. The exception above referred to is the instilling of those rudimentary facts which are to geography what the multiplication-table is to arithmetic. Without these facts, such as the outlines of continents and oceans, which cannot be taught inductively, no comparison, no generalization, is possible; and if they are to be indelibly impressed on the mind, and form part of the groundwork, they must be learned very early. The *why* of geography cannot come till considerable portions of history and science have been answered. These outlines, our multiplication-table, must be taught by maps: they are purely a question of eye-memory. We want neither maps full of details (the old error), nor a single map of a country with only twenty names in it (the modern error), but a number of maps, each one accentuating some single feature, and showing the country in some new connection. Such maps could be produced very cheaply, and we might have a whole series of them. Even grown-up people rarely know the look of a country except in one connection, and are unable, in turning over an atlas, to recognize a map at a glance without the help of the name in the corner. So, in map-drawing, we require far too great elaboration. What we want is, to enable a child to reproduce from memory a rapid outline of Italy as a peninsula of south-western Europe, again as part of the Mediterranean coast-line, and so on. The old school of teachers, who insist on lists of names by heart, argue that "we are bound to train the memory," and that "the memory is strongest in the young." They do not perceive that they are arguing in a vicious circle. If the memory is strong, what need to cultivate it specially? What is needed is to supply it with facts worth remembering. "Give plenty of facts, and some are sure to stick." "Granted," replied the lecturer, "but these are likely to be the least important. From my school lessons on the geography of Italy, I retain the one fact that twelve miles north of Milan there is a village famous for its cheese-making."

Text-books are useful as a guide to the teacher, and as a record of what has been taught to the pupil. The old way of using them — "Get up the next three pages; now shut your books; name the departments of France and their capitals" — is a parody of teaching. Nor is the modern fashion of lecturing, by itself, much better. A lecturer can stimulate and direct study: he cannot supply accurate information; he cannot educe knowledge or test its soundness.

Teachers, by blindly following text-books, fall into the vicious method of taking one country at a time. They should go over the same ground again and again, each time in a new connection, showing the physical, commercial, political connection of one country with other countries. For this we need variety of apparatus, — maps, sections, models, views, magic-lantern slides, and, above all,

the blackboard. Lastly, the pupil must have practical experience in the field. When he has been taught how to observe and record the natural features of his own immediate vicinity, he should be taken to another district, and be taught by contrast. Such is the practice of German schools, but in England we are told that the thing is impossible, that excursionist teaching would end in anarchy. Yet head masters find no difficulty in taking cricket and football teams to play distant schools. If they themselves knew or cared for geography, the difficulty would vanish. "Such," said Mr. Mackinder, "is, in briefest outline, my ideal of geography-teaching in schools; but the lecturer can only propose: it is the examiner who disposes."

SPEED OF RAILROAD TRAINS IN EUROPE.

THE German technical press is at present discussing the speed of express trains. In answer to petitions addressed to him by a number of persons interested, says the *Railroad and Engineering Journal*, the minister of public works declared recently that it would be very difficult to respond to demands of this kind, since the speed of express trains on the Prussian railroads was already greater than in any other European country. If it should be increased, the public would not patronize the railroads.

This assertion, it is shown from statistics recently collected, is not by any means correct. The following table shows the average speed of fast trains in different European countries, and shows that Germany does not by any means occupy the first rank.

Country.	Speed per hour in miles. Including stops.	Without stops.
Great Britain	41.7	44.6
France	32.8	36.2
Holland	32.5	35.0
Belgium	31.8	33.5
North Germany	31.8	34.3
South Germany	31.2	33.0
Austria-Hungary	30.0	32.0
Italy	29.5	31.8
Russia	29.0	31.7

The inferiority of Germany in this point of view finds a marked expression, if we compare the speed of the great Oriental Express, which runs between Paris and Constantinople, passing over the railroads of a number of European countries, including Germany. This train is the fastest long-distance express train run in Europe, and from the time-table the average speed in the different countries is as follows: in France, 40.5 miles per hour; in Germany the speed varies in different sections, being in Alsace-Lorraine, 32.5 miles; in Baden, 35.5 miles; in Würtemberg, 30 miles; in Bavaria, 33.7 miles. In Austria the average speed is 33.5 miles; in Hungary, 34 miles; and in Roumania, 32 miles. This comparison, it will be seen, is not altogether to the advantage of the German lines.

In this connection some comparison may be made of the passenger tariffs in different countries. From this it appears that the lowest charges, both for first and second class passages, are in Belgium, Holland coming next, then Germany, then France, then Austria-Hungary. England and Italy charge the same fare for first-class passages, but the English second-class is considerably lower than the Italian. The highest fares in Europe are in Russia. Third and fourth class fares are not included in this system, as those classes of passengers are not generally carried on the fast express trains.

AMONG THE PUBLISHERS.

BEGINNING with Jan. 1, 1890, Mrs. Fuentesy Capdeville, Madrid, Spain, will publish a new scientific illustrated weekly magazine entitled *La Naturaleza*.

— J. F. Whiteaves has published in the "Transactions of the Royal Society of Canada" (Vol. VII., Section IV., 1889) "Descriptions of Eight New Species of Fossils from the Cambro-Silurian Rocks of Manitoba," illustrated by six plates.

— D. Appleton & Co. have ready "Appletons' Handbook of Winter Resorts." They have in press a book by Frank Vincent, entitled "Around and About South America." Mr. Vincent circumnavigated South America, and visited the various places of interest in the different countries, including many in Brazil. The volume will be fully illustrated. They have in press a valuable historical work in "James G. Birney and the Genesis of the Republican Party," by Gen. William Birney.

— In the Christmas number of *The Ladies' Home Journal*, Theodore R. Davis gives a glimpse inside the White House and of the State dinners under several administrations, and Edward W. Bok tells what are the literary tastes of two such men as Gladstone and Bismarck.

— John Howard Appleton, professor of chemistry, Providence, R.I., author of "Beginner's Handbook of Chemistry," "The Young Chemist," "Qualitative Analysis," "Quantitative Analysis," "Laboratory Yearbook," has issued his "Laboratory Yearbook for 1890." This publication is now in its eighth year.

— Charles Scribner's Sons have just published "Among the Cannibals," which is an account by Carl Lumholtz of his four years' travel in Australia, and of camp-life with the aborigines of Queensland, considered to be the lowest race of *homo sapiens* known to exist.

— Robert M. Lindsay, Philadelphia, Penn., announces to be published in December an etched portrait of Charles Darwin, after the painting by W. W. Ouless of the Royal Academy, London, and etched by G. Mercier of Paris, pupil and collaborateur of the eminent Rajon, recently deceased. The size of the plate is about twelve by fifteen inches.

— The January number of *Scribner's Magazine* will appear with additional space, and a new department at the end of the number, conducted under the title "The Point of View." An opportunity is here given to the best writers for a brief and familiar discussion of subjects of both passing and permanent interest. In the January number the subjects touched are "The Barye Exhibition," "Thackeray's Life," "Social Life in Print," and "The French as Artists." The success of the magazine has been such that the publishers feel justified in adding these new pages to a magazine already low in price.

— E. & F. N. Spon have just published "Inventor's Manual: How to Make a Patent Pay," by an experienced and successful inventor. Thousands of useful inventions are every year patented, but on which the inventor does not realize any thing, simply for want of information how best to proceed to introduce or dispose of his invention. Among the subjects treated in this work are how to invent; how to secure a good patent; value of a good invention; how to exhibit an invention; how to interest capital; how to estimate the value of a patent; value of design patents; value of foreign patents; value of small inventions; advice on selling patents; advice on the formation of stock companies; advice on the formation of limited liability companies; advice on disposing of old patents; advice as to patent attorneys; advice as to selling agents; forms for assignments, licenses, and contracts; State laws concerning patent rights.

— Messrs. Putnam have issued in the Story of the Nations Series a volume on "Early Britain," by Alfred J. Church. It begins with the earliest authentic records, and closes with the Norman Conquest. Being intended for popular reading, it of course has not the philosophical character that a work on such a subject might have, but from its own point of view it has considerable merit. The author has followed the best authorities, though always with independent judgment; and he has probably given as clear an account of the most stirring events in early English history as his space and materials permitted. The main fault of the work, as of the majority of historical books, is the excessive attention given to military affairs to the neglect of other matters of greater importance, Mr. Church evidently thinks the Roman occupation of Britain of more consequence than some writers do, for he devotes one-fourth of his book to it; and he is not disposed, like some, to think that all that is valuable in English life is due to the Teutonic settlers. On the whole, he has made a judicious and readable book. We are sorry to have to add that, like one other volume in this series which we had occasion to notice some time ago, it contains a number of grammatical blunders, such as singular nouns with plural verbs, abverbs used for adjectives, and so forth, which ought never to be seen in a respectable publication.

— The contents of the *Modern Science Essayist* for October, November, and December are, respectively, "Evolution as Related to Religious Thought," by John W. Chadwick; "The Philosophy of Evolution," by Starr Hoyt Nichols; and "The Effects of Evolution on the coming civilization," by Minot J. Savage. The *Essayist* is published by the New Ideal Publishing Company of Boston, Mass. The publication of this series of fifteen essays on evolution (which were delivered as lectures under the auspices of the Brooklyn Ethical Association) was undertaken in response to a demand for a correct statement, in popular form, of the leading ideas, inferences, and tendencies involved in the acceptance of the evolution philosophy, together with a clear statement of the main lines of evidence or proof by which the conception of evolution is sustained. The plan of the series involved not only the treatment of the physical and biological phases of the subject, but also its ethical, social, religious, and philosophical aspects; the whole being introduced by biographical sketches of the two men of our time whose names are most intimately associated with the evolution hypothesis, — Spencer and Darwin. The three numbers mentioned above complete the series of fifteen. They will be followed by other essays of a similar tenor.

— The December number of the *Political Science Quarterly* opens with an article on the deferred constitutional convention of New York State, by the Hon. Seth Low, president of Columbia College. George Gunton attacks the economic basis of socialism; namely, Karl Marx's theory of "surplus value;" the Rev. Samuel W. Dike reviews the new and important government report on marriage and divorce; Worthington C. Ford (late of the State Department) criticises and opposes the scheme of substituting silver for legal tender notes; Professor F. W. Maitland of Cambridge, England, completes his valuable survey of the materials of English legal history; and Professor F. J. Goodnow of Columbia College begins a description of the recent re-organization of local government in Prussia. Twenty-two recent American, English, German, French, and Italian works are reviewed. Among the reviewers, besides the editors, are Professors Hadley of Yale, Giddings of Bryn Mawr, and Ashley of Toronto University; J. B. Moore, assistant secretary of State; and Sir George Baden-Powell, M.P. The "Record of Political Events" (previously published in the *New Princeton Review*) is continued to Nov. 1.

— Messrs. Putnam have published a work on the pleasures of country life by Philip G. Hubert, jun., entitled "Liberty and a Living." The author had been engaged in constant work as a journalist, but abandoned a portion of his work, and took a small country home on Long Island, where he lives for eight months of the year occupied with gardening, fishing, etc. He still does some writing, however, and in the winter spends four months in the city in journalistic work. Thus his income still comes mainly from his pen, his country work being carried on chiefly for pleasure; and the life he thus leads he holds up as the true ideal. He sings its praises with no little fervor; and, so far as mere enjoyment is concerned, there is something to be said for it. But then, we are not placed in this world for selfish enjoyment, but to serve humanity; and the life that Mr. Hubert describes is wholly destitute of any such object. It is a life of idleness and sport, with only so much work as is necessary to support existence; and such a life is even less honorable than that of the money-getter whom Mr. Hubert so much despises.

— A work will shortly be issued anonymously by the J. B. Lippincott Company, Philadelphia, which may excite widespread interest in political circles. It is entitled "Justice and Jurisprudence: An Inquiry concerning the Constitutional Limitations of the Thirteenth, Fourteenth, and Fifteenth Amendments." Advance sheets show an inside political knowledge of events and allusions which indicate a close connection between the author and the present administration, and it bids fair to have an important bearing upon the policy and future of parties in this country. The book is free from partisanship or sectionalism, and is a bold and original treatment of the race question. As a legal argument on one of the most important subjects of the day in America, and as a criticism of the decisions of the highest judicial tribunal of the land, the work will commend itself. An appendix contains a statement of all legislation, National and State, and a digest with table of every case, Federal and State, touching the race question or civil rights. The volume may become an authority upon constitutional liberty, and a guide for foreign as well as American statesmen, not less than an educational work for the general public, for whose benefit ostensibly it has been prepared.

— Messrs. Munn & Co. announce as now ready "Experimental Science," by George M. Hopkins. This book treats on the various topics of physics in a popular and practical way. It describes the apparatus in detail, and explains the experiments in full; so that teachers, students, and others interested in physics, may readily make the apparatus, and perform the experiments without difficulty. The aim of the writer has been to render physical experimentation so simple and attractive as to induce both old and young to engage in it for pleasure and profit. A few simple arithmetical problems comprise all of the mathematics of the book. Many new experiments are here described for the first time.

— We glean the following news items from *The Publishers' Weekly*. Egmont Hake has edited the diary kept by Gen. Gordon during the Tai-ping rebellion. It will be published shortly, illustrated with portraits, maps, and plans. R. D. Blackmore's recent appearance in court as complainant against a man who had stolen twenty-five dollars worth of his pears brings out the fact that the author of "Lorna Doone" is better known at his home in Teddington as a market-gardener than as the author of some of the most charming of contemporary works of fiction. Emile Ollivier, the ex-minister of the French Empire, has in press his new work, "1789 and 1889." The volume treats of the Revolution, and the social, political, and religious work of the movement of 1789, concluding with a programme of reforms to be effected in the political organization of latter-day France, and notably in the management of universal suffrage and the present parliamentary system. Douglas Sladen, the Australian poet, who has been making a tour of Canada from Halifax to the Pacific, is now in Victoria, B.C., collecting information for a book which he intends writing on Canada. The volume will contain his personal impressions of the Dominion, statistics of her trade, her relations with the mother-country and reciprocal benefits derived from the connection, besides the advantages offered by Canada as a trade route between England and the colonies of the Pacific. Gustav Freytag's "Der Kronprinz und die deutsche Kaiserkrone" was printed in full in the *Belletristisches Journal* of this city of Nov. 14. It will be issued at once by George Bell & Sons, in an English translation, under the title of "The Crown Prince and the German Imperial Crown." A reply to this book, by Dr. Otto Arendt, will be published shortly by Walther & Assolant of Berlin. Freytag is a Conservative; Dr. Arendt, a Liberal; and it is expected that the latter's reply will make considerable sensation in the German political world. A number of gentlemen interested in the University of Pennsylvania have established a publishing company under the name of the University Press. Their purpose is to control the present publications of the university, and to establish such new periodicals as the needs of the institution may suggest. At least four new magazines will be issued by the company soon after Jan. 1. *The Arena* is the title of a new monthly magazine, published in Boston, which intends to devote itself to the serious discussion of serious public questions. The first issue, published in November, and the December number, contained contributions from the Rev. M. J. Savage, W. H. H. Murray, Mary A. Livermore, Helen Campbell, O. B. Frothingham, N. P. Gilman, and others. For the January number, articles by Col. Ingersoll, Henry George, and Dion Boucicault are promised. The American edition of *Artistic Japan*, published by the Artistic Japanese Agency, 220 Fifth Avenue, will hereafter be published simultaneously with the English, French, and German editions issued abroad. The edition printed for this country contains precisely the same engraved and colored plates as the European editions, which are printed in color by M. Gillot of Paris, under M. S. Bing's personal direction. The series of plates issued with this journal will form a valuable collection on various subjects, desirable for amateurs, architects, decorators, and artists, as well as all industrial workers needing suggestions in design, color, motive, or form.

The Atlantic Monthly

FOR 1890 WILL CONTAIN

SIDNEY.

A New Serial Novel
MARGARET DELAND,
Author of "John Ward, Preacher."

OVER THE TEACUPS.

A Series of Papers by
OLIVER WENDELL HOLMES.

FELICIA.

A Serial by a New Writer,
MISS FANNIE MURFREE,
Sister to "Charles Egbert Craddock."

HISTORICAL PAPERS.

By JOHN FISKE.

SOME FORGOTTEN POLITICAL CELEBRITIES.

A Series of Papers by
FRANK GAYLORD COOK.

Also, Stories, Poems, Travel Sketches, Essays, Papers on Education, Politics, Art, etc., by the best American Writers.

TERMS; $4 00 a year in advance, postage free.

Postal Notes and Money are at the risk of the sender, and therefore remittances should be made by money order, draft, or registered letter, to

HOUGHTON, MIFFLIN & CO., BOSTON,

Important Announcement.

To CHEMISTS,
MANUFACTURERS
and ENGINEERS.

CHEMICAL TECHNOLOGY; or,

CHEMISTRY IN ITS APPLICATION TO ARTS AND MANUFACTURES. Edited by Charles Edward Groves, F.R.C., and William Thorp, B.Sc.

VOL. I. NOW READY.

FUEL AND ITS APPLICATIONS,

By E. J. Mills, D.Sc., F.R.S., and F. J. Rowan, C.E., assisted by others, including Mr. F. P. Dewey, of the Smithsonian Institute, Washington, D.C.

7 *Plates and* 607 *other illustrations. Royal octavo pages* xx + 802. *Half-Morocco*, $9. *Cloth*, $7.50.

MAILED POSTPAID ON RECEIPT OF PRICE.

N. D. C. Hodges, 47 Lafayette Place,
NEW YORK.

NOW IN PRESS.

"FORT ANCIENT."

A large work of 200 pp. with 35 full-page illustrations on the greatest of all Ohio Valley Earthworks, and similar enclosures.

By Warren K. Moorehead, assisted by scientists from Washington.

It is compiled from a careful survey and is correct in all details.

The entire summer was spent in surveying, excavating, photographing and preparing this work.

Fort Ancient consists of 18,712.2 feet of embankment, and in size, state of preservation and importance as an aboriginal fortification is unequalled in this country.

Price of book, $2 00.

It will be ready for sale Dec. 1st.

Illustrated prospectus mailed free to any address. Send for one.

WARREN K. MOOREHEAD,
Smithsonian Institution, Washington, D.C.
Published by Robt. Clarke & Co., Cincinnati.

Correspondence solicited with parties seeking publishers for scientific books.

N. D. C. HODGES,
Publisher of Science,
47 Lafayette Place,
New York.

TO BE PUBLISHED IN DECEMBER, AN ETCHED PORTRAIT OF

CHARLES DARWIN,

after the painting by W. W. Ouless, of the Royal Academy, London, and etched by G. MERCIER, of Paris, pupil and colaborateur of the eminent Rajon, recently deceased.

The portrait by Ouless, from which this plate is etched, is regarded as the finest likeness ever painted of the great scientist, and the etching by this well-known etcher is certain to be an admirable transcription.

The edition will be limited as follows:

25	Remarque Proofs on Parchment, . . .	$30 00
75	" " Japan, ...	20 00
100	Artist's " "	15 00
100	Prints, ...	10 00

300 impressions in all, and the plate will then be destroyed.

ROBERT M. LINDSAY,
Eleventh and Walnut Sts.,
Philadelphia, Pa.

JUST PUBLISHED.

POPULAR MANUAL OF VISIBLE SPEECH AND VOCAL PHYSIOLOGY.

For use in Colleges and Normal Schools. Price 50 cents. Sent free by post by

N. D. C. HODGES, 47 Lafayette Place, New York.

LONGMANS, GREEN & CO.

HAVE JUST PUBLISHED

THE BLUE FAIRY BOOK.

EDITED BY ANDREW LANG.

With 136 Illustrations by H. J. FORD and G. P. JACOMB HOOD.

Crown 8vo, Gilt Edges, Ornamental Blue and Gold Cover, 390 *Pages*, $2.00.

"No matter whatever else the children may find in their stockings Christmas morning, they should surely find a copy of 'The Blue Fairy Book.'"—*Chicago Daily News.*

"The loveliest collection of fairy stories that any Christmas holiday ever brought is here, edited by Andrew Lang. With its exquisite charm of the stories rendered still more attractive by the pretty blue and gold fancy in binding."—*Boston Traveller.*

"The most captivating thing of its kind which has appeared in a long time. Nothing in the impending holiday publication race will be likely to surpass this substantial, handsome little volume."—*Brooklyn Eagle.*

THE STORY OF MUSIC.

By WILLIAM J. HENDERSON. 12mo, ornamental cloth cover, gilt top, $1.25.

"Unique in its comprehensiveness, and remarkable for the clear and concise way in which a great mass of material is treated in its pages. No one who is interested in the study of music will fail to read every chapter after beginning it."—*N. Y. Times.*

"Admirable for its succinctness, clearness, and gracefulness of statement. Mr. Henderson has accomplished with rare judgment and skill the task of telling the story of the growth of the art of music without encumbering his pages with excess of biographical material."—*N. Y. Tribune.*

"The choice style in which this book is written lends its added charms to a work most important on the literary as well as on the artistic side of music."—*Boston Traveller.*

HISTORY OF PHŒNICIA. By GEORGE RAWLINSON, M.A., Camden Professor of Ancient History in the University of Oxford, Canon of Canterbury, etc., etc. With 2 Maps, 10 Plates, 122 Woodcuts in the text, and full Index. 8vo, pp. xxii.-583, cloth, $6.00.

CARDINAL LAVIGERIE AND THE AFRICAN SLAVE TRADE. Edited by RICH. F. CLARKE, S.J., Trinity Coll., Ox. 8vo, $4.50.

*** This book appears under the authority of the Cardinal, and contains the latest details of his work, and of the crusade he is organizing for the abolition of the African slave trade.

PRINCE, PRINCESS, AND PEOPLE: An Account of the Social Progress and Development of Our Own Times, as illustrated by the Public Life and Work of the Prince and Princess of Wales, 1863-1889. By HENRY C. BURDETT. With Portraits and Autographs of their Royal Highnesses, and Illustrations of their Northern House. 8vo, $6.00.

"TO MEET THE DAY" THROUGH THE CHRISTIAN YEAR: Being a Text of Scripture, with an Original Meditation and a Short Selection in Verse, for Every Day. By A. K. H. B. Cloth, red edges, crown 8vo, $1.50.

RECENT FICTION.

MR. BRANDER MATTHEWS' NEW BOOK.

A FAMILY TREE: AND OTHER STORIES. By BRANDER MATTHEWS. 12mo, ornamental cloth cover, $1.25.

"Always a clever, ingenious story-teller."—*Christian Union.*

"So many plots suitable only for short stories are nowadays published in book-length that a collection of straightaway tales deserves to be regarded as a streak of luck for readers."—*New York Herald.*

GERALD FFRENCH'S FRIENDS. By GEORGE H. JESSOP. 12mo, ornamental cloth cover, $1.25.

"Mr. George H. Jessop is a keen observer and a sure-handed delineator. His forcible outline sketches always fix and fascinate attention. The book as a whole is delightfully entertaining, and many of its character studies are faithful enough to deserve long life."—*Boston Times.*

GOBI OR SHAMO; A Story of Three Songs. By G. G. A. MURRAY. Crown 8vo, $1.25.

*** "The Great Desert of Gobi or Shamo."—*Cornwell's Geography.*

"As full of cleverness as an egg is of meat."—*Saturday Review.*

SUCH IS LIFE. A Novel. By MAY KENDALL, author of "From a Garret," "That Very Mab," "Dreams to Sell," etc. 12mo, cloth, $1.25.

"Vital with personal experience; it is the exposition of what some one has felt and suffered; it is magnetic, and will appeal strongly to one class, at least, of readers, who will linger over and return to it, gaining from its broad and thoughtful pages."—*Boston Literary World.*

"It is unusual; it has the constant charm of the unexpected, and has in it both pathos and humor. The style is so choice, so refined, so full of all-pervading beauty, that it is a special delight to fall upon such a book."—*Boston Traveller.*

Messrs. Longmans, Green & Co. will be happy to send their New General Catalogue upon application.

LONGMANS, GREEN & CO., 15 East Sixteenth Street, New York.

— "'Evolution of Sound' Evolved" is a review of the article entitled "The Nature of Sound," in "The Problem of Human Life," by Marcellus Thompson, professor of natural sciences in Garfield University, Wichita, Kan. To this work is appended an account of some original experiments in electricity which Professor Thompson conducted when a candidate for the master's degree at the University of Michigan. This work has been warmly received, as witness testimonials from John W. Langley, professor of general chemistry in the University of Michigan; Alfred Fairhurst, professor of natural sciences in Kentucky University; B. J. Radford, associate editor of the *Christian Standard;* John B. De Motte, professor of physics in DePauw University; O. P. Hay, professor of biology in Butler University; David S. Jordan, president of Indiana State University; A. E. Dolbear, professor of physics in Tufts College; C. Williams Parks, professor of physics in Rensselaer Polytechnic Institute.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

A Belated Dandelion.

THE day before Thanksgiving I found in full bloom a fine dandelion-head measuring one and one-half inches in diameter; yet the record of temperatures for the November just past shows a lower average than that of any November in Kansas since 1880.

E. B. KNERR.

Atchison, Kan., Dec. 5.

Is Man Left-Legged?

LAST Sunday, while walking on the beach at Nahant, we tried some experiments bearing on the subject. We found that, walking either forward or backward with the eyes shut, we bore to the right, but in running either forward or backward we bore to the left. This last fact surprised us somewhat at first; but we thought it might be explained from the fact that, the left leg being the stronger, there would be a stronger spring from the left foot in running, which would make the right leg take the longer step. We should be glad to hear if others have tried these experiments, whether with the same or different results.

FRED'K A. LOVEJOY.
FRANCIS H. ALLEN.

West Roxbury, Mass., Dec. 8.

INDUSTRIAL NOTES.

The Crocker-Wheeler Electric Motor.

THE Crocker-Wheeler Electric Motor Company of this city are now putting on the market a series of electric motors which show a considerable advance in design, construction, and efficiency. Two of their smaller motors are shown in the illustrations on this page. Fig. 1 shows a ⅛-horse-power motor belted to a small three-piston suction and force pump, which is capable of lifting a thousand gallons of water per day a height of a hundred feet, and other quantities a correspondingly greater or less height. When desired, the motor is connected to the pump by toothed or friction gearing instead of by a belt.

By means of an automatic attachment to the ordinary float in the water-tank, the electric current is cut off from the motor when the tank is full, thus stopping the pump until enough water has been used from the tank to allow the float to fall, thus starting the motor and pump again by switching on the electric current. This cycle of operations being entirely automatic, the water-supply is never exhausted, and no more electric energy is absorbed than is just sufficient to pump enough water to supply the demand.

Fig. 2 shows one of the new Crocker-Wheeler arc motors with fan, and a regulator which effects any desired change in the speed and power of the machine by simply moving the armature out of the field. By this simple device the necessity of a switch, complicated windings, and attendant evils are entirely overcome.

The motors are built of very few pieces, and are strong and durable. They are designed with a broad base and a low centre of gravity, in order to render them perfectly steady and quiet in their operation. In their care they require a minimum of attend-

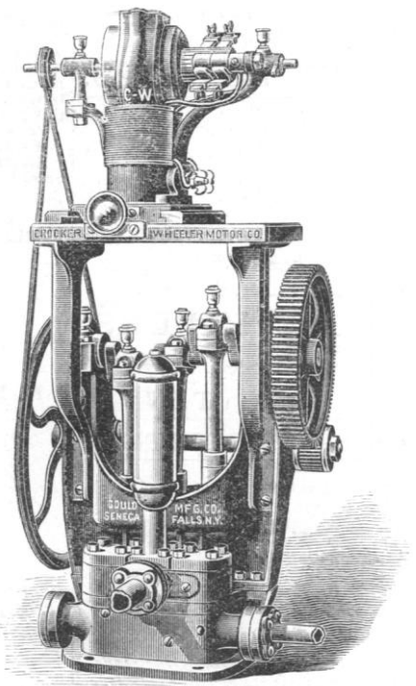

FIG. 1. — NEW C.-W. ELECTRIC PUMP.

ance. They are arranged to be controlled by either of three methods of regulation, — for constant load, for variable speed, and for constant speed, — any one of which is obtained by attaching the corresponding regulating fixture.

The motors are arranged so that they can be reversed by simply inverting the brush-holders upon the clamping-rods, so that the upper brushes are placed below, and the lower ones above. By

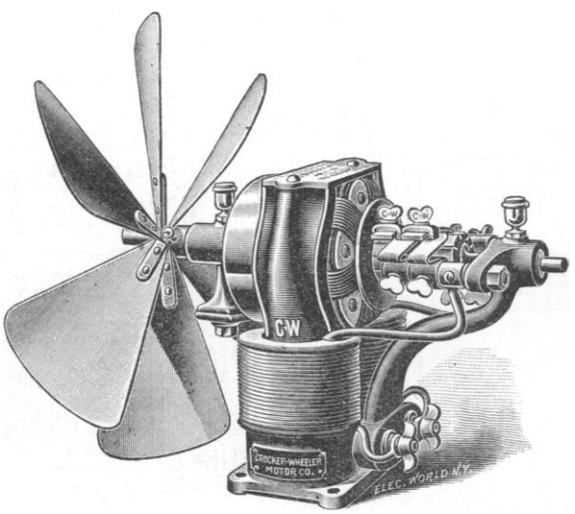

FIG. 2. — NEW C.-W. ELECTRIC FAN.

this device the machines can be run either right-handed or left-handed without taking apart or changing any connections. They are wound for every kind of circuit, and those of different windings are always compared to see if the same efficiency and proportion of ampère-turns are maintained. On the smallest size, about 2,500 ampère-turns are used to magnetize the field, the total loss in the machine due to resistance never being permitted to exceed about 47 watts.